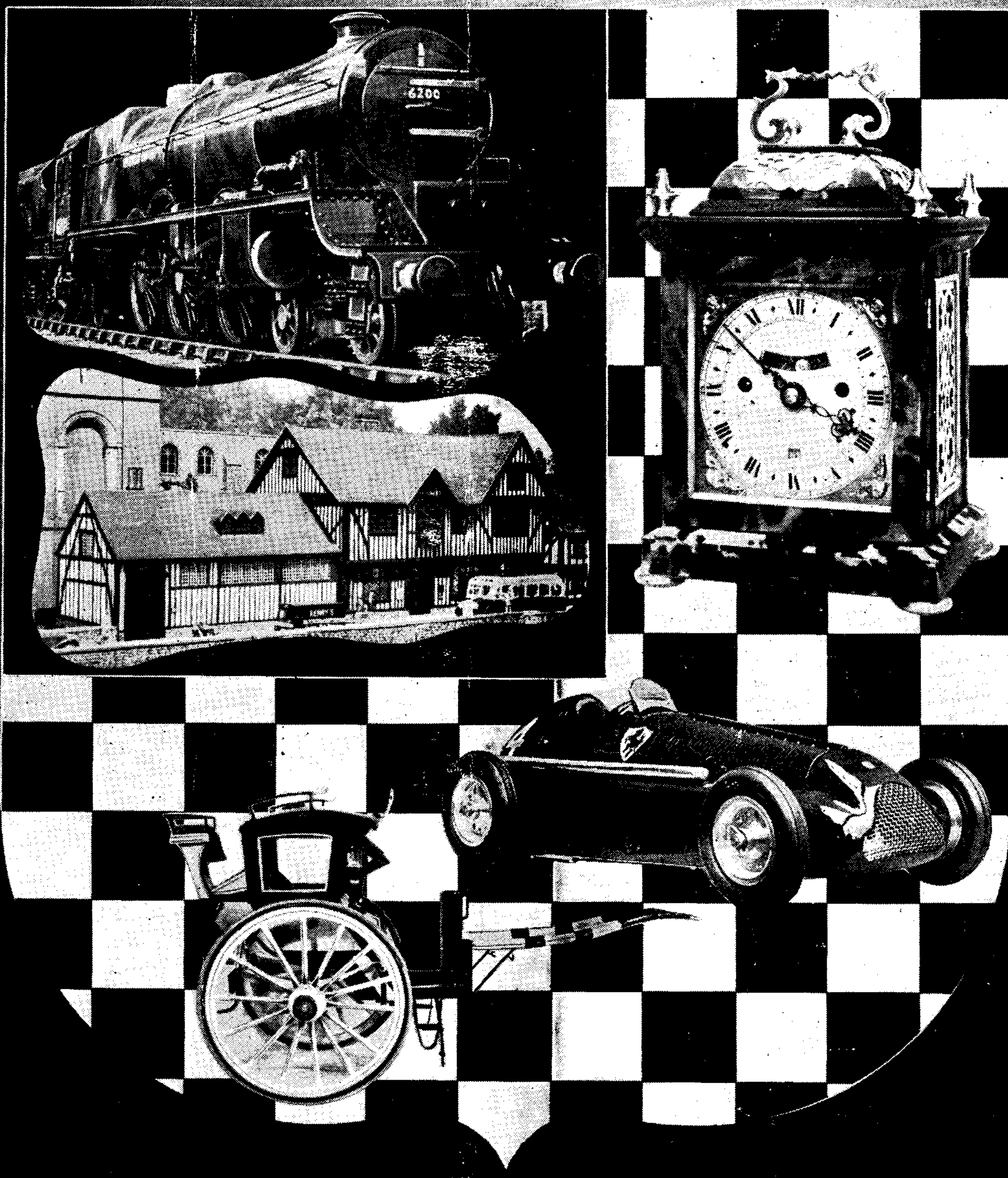
THE MODEL ENGINEER



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The MODEL ENGINEER

PERCIVAL MARSHALL & CO. LTD., 23, GREAT QUEEN ST., LONDON, W.C.2

25TH AUGUST 1949 VOL. 101 NO. 2518

SMOKE RINGS

As Good As Most

● IMMEDIATELY AFTER Sir Frederick Handley Page had opened the M.E. Exhibition, it became the hive of friendly chatter and animation that is typical of this annual festival in the model engineering calendar. The interest of the visitors becomes centred on one, or all, of three main objectives ; first, to inspect the models ; secondly, to look for old friends and acquaintances and to make new ones, and thirdly, to see what is displayed on the trade stands.

So far as the first of these objectives is concerned, there is plenty to delight every visitor. Nobody, after a tour of the hall, could have the slightest doubt that our natural, and national, craftsmanship is as much alive today as it has ever been. There may be no " best ever " exhibit to be seen this year, but, taking all the various stands as a whole, there are plenty of exhibits which are up to the best standard in our hobby.

This is reflected in the far from easy task with which the judges of the competition entries are bravely struggling. The standard of workmanship is remarkably high and uniform ; each entry has its merits and demerits, a fact which demands that the judges shall not skimp their job.

But apart from the competition section, there are the models in the loan section to be examined. Here we find a wide variety of subjects, and each possesses an interest of its own ; it may be a well-known model with a history, or it may be an outstanding example of our craft, or a model built to test out some theoretical idea. But, whatever it is, it is almost certain to have some more or less romantic associations which add much to its interest and value.

The predominantly friendly atmosphere which pervades the whole place is always a feature of our show. Every day during the show, we are meeting old friends and acquaintances, some of whom we have not seen for at least twelve months, and we come face to face with others who, previously, we have known only as names, but have come to regard as friends, nevertheless ; for their acquaintance was made only through the medium of correspondence. We are always glad of the opportunity which the " M.E." Exhibition affords of being able to shake hands with a former pen-acquaintance.

The trade stands, this year—thirty-four of them—are an exhibition on their own, as usual. But they now seem to have entirely shaken off the crippling restrictions imposed by wartime conditions, and they wear something much more like that pre-war look which indicates that business is good. Here, once again, we are meeting old friends and making new ones, since, in this respect, all sections of the exhibition are alike.

There may be some who are disappointed in the show ; perhaps they have exaggerated their preconceptions of it. There may be some who are well pleased with what they see ; perhaps they did not anticipate too much. Our own opinion is that the show is at least as good as most.

Miniature Locomotive Driving

● THE RECENT articles by "1121" have pointed out the tactics and antics of certain types of drivers who are sometimes met with when tracks are being operated at exhibitions, fetes, gala days and even at ordinary track meetings organised by clubs and societies. It is clear that, to obtain the best results, really scientific driving is required, especially when the load behind the driver is up to the maximum possible for the engine to move.

We have seen drivers whose one idea of driving, to judge from their methods, is to open the regulator to the full, put the engine in full gear and hope for the best! The usual result is a fury of slipping from the engine, accompanied by something of a pyrotechnic display from the chimney, but little or no movement of the train. Or, it may be that if the engine succeeds in starting the train, she does so, slipping violently all the while, vainly trying to work up some speed.

What a waste! And, in certain circumstances, what a potential source of danger! We often marvel that such drivers enjoy the freedom they do. The S.M.E.E. is to be highly commended for initiating the idea of witholding permission to drive from anyone who cannot pass a preliminary test, and we would like to see the idea adopted by all clubs and societies, especially when the general public provides the passengers.

More News of Fowler Engines

● MR. CHARLES LLOYD, of Liverpool, writes to say that he has seen two examples of the lesser-known single-cylinder ploughing engines on dredging work near St. Helens, Lancs, though they have now gone elsewhere. They were Nos. 1576 and 2425.

Working with them was another Fowler plougher, No. 15347, and on looking her over, Mr. Lloyd was surprised to find that the responsibility for feeding the boiler was being borne by an injector alone, there being no trace of any pump. There is, of course, the possibility that a pump was originally fitted, and lost subsequently, since its absence is very unusual.

A New Locomotive Club

● WE HAVE received a letter from Mr. John Fowler, 21, Nares Street, Witton, Blackburn, Lancs, informing us of the recent formation of the Blackburn "Live Steam" Locomotive Club. To date, there are thirteen members, and the objectives are the building and running of small locomotives in 2½-in. and 3½-in. gauges.

We are glad to learn that the new club has been fortunate enough to acquire some land and, since May 24th last, good progress has been made with the construction of a continuous track which embodies three straight sections of 21 ft., 41 ft., and 48 ft., respectively, and three curves of 35 ft. radius, giving a total length of 330 ft., or 1/6th of a mile. This should provide, when completed, an excellent opportunity for testing small locomotives and of giving enjoyment to the fraternity for many years to come. We wish the venture every success; in the meantime, any interested readers who can add to the existing membership are invited to make contact with Mr. Fowler at the address given above.

S.M.E.E. Affiliation

● WE HAVE been advised that the Hon. Secretary and treasurer of the S.M.E.E. Affiliation is now Mr. J. W. Reed, 60, Ennerdale Drive, Kingsbury, London, N.W.9; telephone: Colindale 8214. All club secretaries and others concerned should make a careful note of this.

News from Grantham

● MR. S. L. REDSHAW, hon. secretary of the Grantham Society of Model Engineers, has sent us some news of the progress of the society since its foundation last May.

The Corporation of Grantham recently opened a "Community Hut" as a first step towards a permanent Centre which will be built when restrictions are eased. But the society applied for the use of these premises and succeeded in obtaining the use of a room for meetings which, at present, are held on alternate Wednesdays.

Search for workshop accommodation led to an interview with the local Education authorities; the result is that the society was offered an arrangement similar to that negotiated by the Darwen society. For a very small fee per three-month term, plus the cost of materials from school stocks, members will be able to attend classes in the school workshops every Wednesday evening from 7 to 9 p.m., beginning with the September term.

Grantham certainly appears to have overcome the two main difficulties which confront any newly-formed society, namely, the provision of a meeting-place and the means to enable members to make models, or, at least to augment their own workshop facilities. The start may be somewhat modest, but it is in the right direction and can scarcely fail to be a stepping-stone to future expansion.

Hastings Exhibition

● WE LEARN that the second model engineering exhibition to be organised by the Hastings and District Society of Model and Experimental Engineers has been a successful one from every point of view. Many new models, from members and on loan, were to be seen, and in addition to the locomotive track, working model stand and car track, the displays of flying by the Hastings Aeromodellers, on the green outside the halls, attracted much attention.

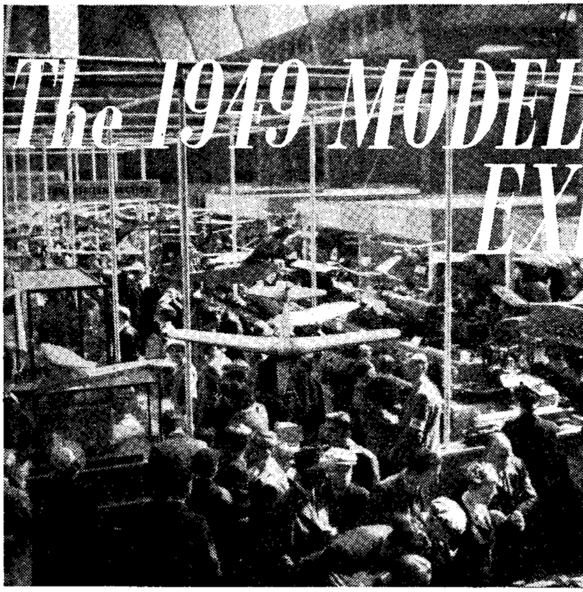
The Hastings Model Yacht Club exhibited thirty models surrounded by several trophies which they had won this season.

One of the high-lights of the show was a model of the s.s. *Arnhem*, which, however, had to have its decks removed to be appreciated. Removal of the top deck revealed some forty cabins, all furnished, a dining-room with about forty tables and four chairs to each, a lounge, a galley and a cocktail bar complete with bottles and glasses. When this deck was removed, the deck below it had two hundred and seventy cabins, all furnished, even down to a water-jug on each washstand.

In the car department, all records for the 2.5, 5 and 10 c.c. classes were broken, the 10 c.c. and track record now standing at 107.2 m.p.h.

It is gratifying to learn that the general standard of work displayed was well above that of last year.

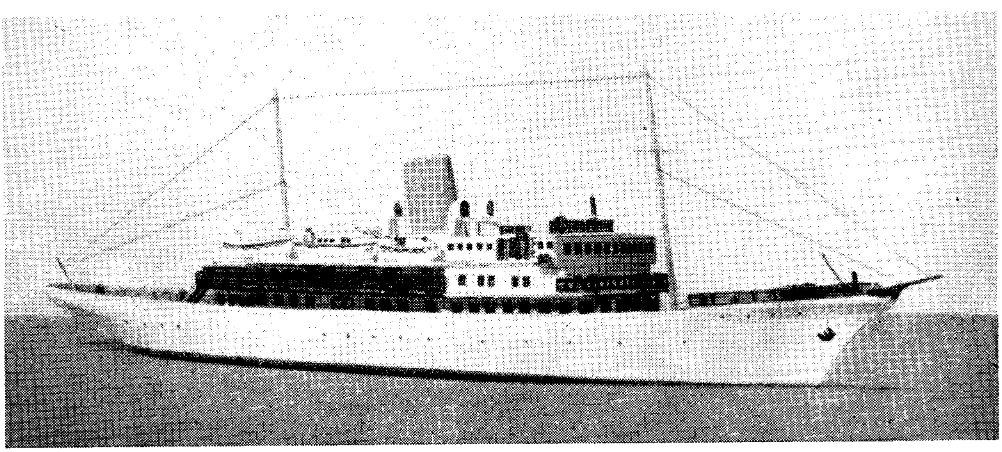
The 1949 MODEL ENGINEER EXHIBITION



*Further Notes and Pictures of some of the Entries

COMING now to the working ship models, the special qualities required in this type are somewhat different from those of the purely representational model. The general proportions, while still important, have sometimes to be sacrificed in the interests of seaworthiness and stability. There is considerable skill in deciding how and to what extent proportions may be modified without unduly minimising the resemblance to the prototype. The power plant in a power-driven model should be appropriate to the type. A petrol engine suitably silenced should be used in a cabin cruiser and might even be used in a destroyer, but it would be out of place in a paddle steamer or a liner. Similarly, an electric motor, while quite appropriate for a passenger steamer fails to give the impression of power and speed associated with a destroyer. The deck fittings for a working model should be chosen with care, and the more delicate refinements which are so important in a representational model would be inappropriate, as they would be liable to damage in actual operation. The art of designing the external fittings of a working model lies in including only such as help most in giving the correct general impression of the ship, and in simplifying the details of these in such a manner as to retain the robust quality necessary to withstand handling. The hull of a working model, whether of a sailing or a power-driven ship, calls for sound judgment and a

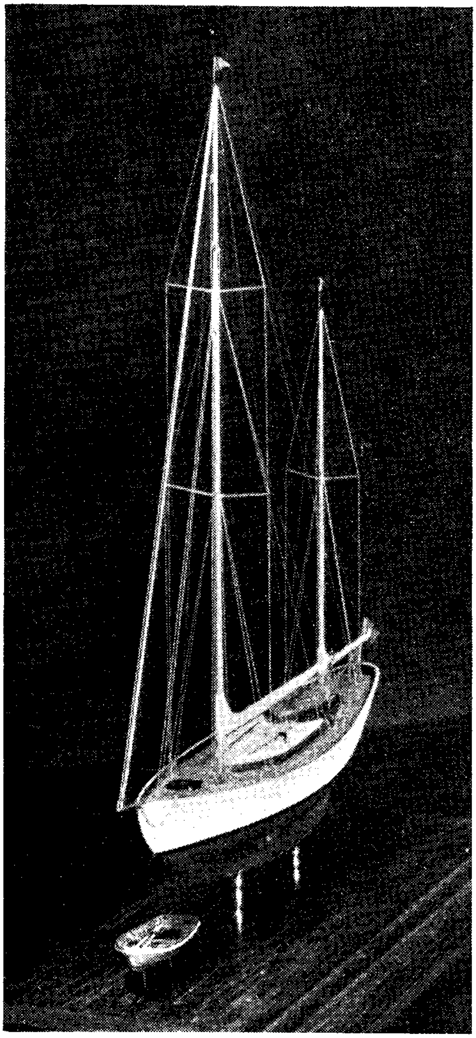
**Continued from page* 203, "*M.E.*," *August* 18, 1949.



A miniature model of the steam yacht "Rover," by R. Dobree-Carey

considerable experience in design, that is if it is to reach the prize-winning level in an exhibition or a regatta. Hull design in model yachts has long been recognised as the basis of satisfactory performance, and the same applies no less to the working model whether of a power-driven or a sailing ship. This altered point of view must be borne in mind when comparing the different classes of models.

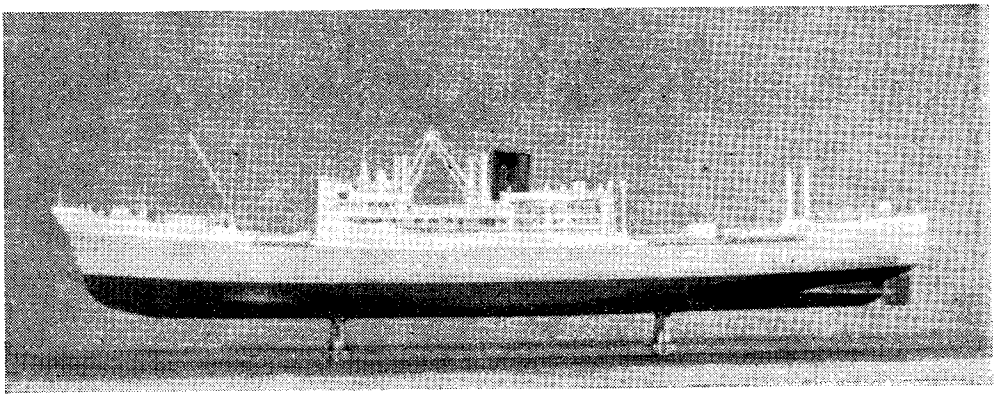
There is now a keen and growing interest in



A model of his yacht by the owner C. S. Sandeman

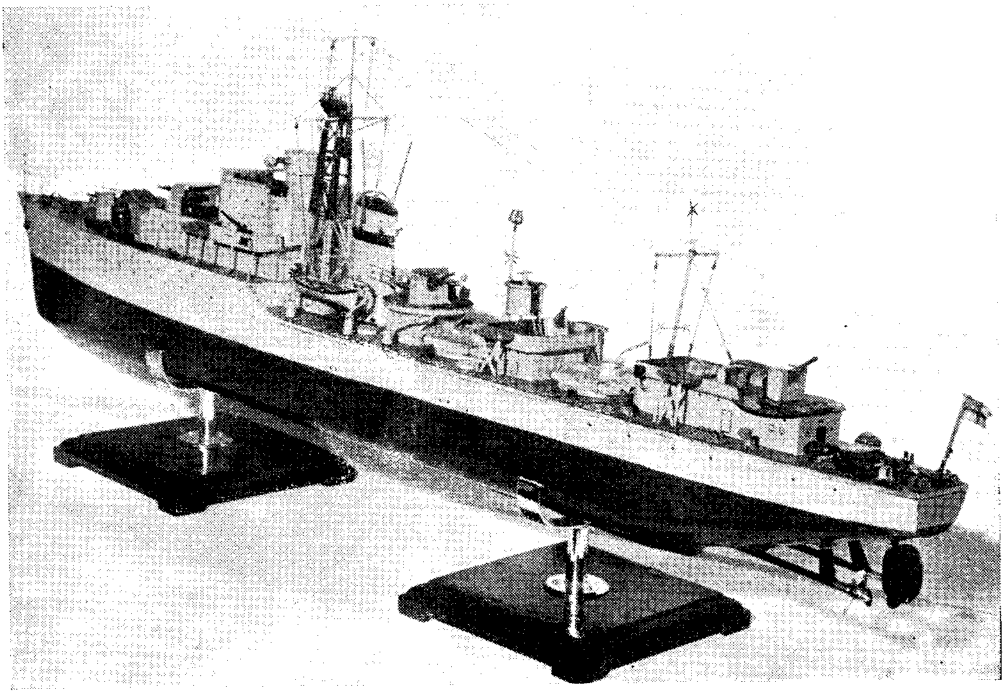
models of prototypes of sailing vessels as distinct from racing yachts and, to our minds, this is opening-up a very fascinating phase of ship modelling. The problem of handling a sailing ship has always been more difficult than that of handling a power-driven vessel, and this is reflected in the handling of these models. There is a big field here for the experimenting and inventive mind. The best type of control for a square-rigged model remains to be developed, some exponents preferring to retain the braces and sheets as in the actual ship, and others preferring to sacrifice realism for efficiency and to redesign the gear as is done with a model yacht, making everything subservient to handiness and speed. We consider that perhaps a middle course can be found, especially as these models are sailed to recreate for us the glory that was sail and not exclusively for speed—unless, of course, we institute racing classes for square riggers and go all out for speed. A fleet of square riggers sailing neck-and-neck would indeed be a thrilling sight. The models on view at the Exhibition include a Thames Barge entered by Mr. J. J. Starkey, of Southend-on-Sea, a 16-gun Naval Brig, by Mr. F. Pearson, of London, S.W.1 and, we hope, a barquentine by the well-known marine artist, Mr. Peter M. Wood, of Kensington. These may often be seen sailing on the Round Pond, Kensington, especially on Sunday mornings, Mr. Starkey frequently coming up from Southend with his boat for a day's sailing. This is a hefty model having a hull 52 in. long overall and a displacement of 54 lb., the scale being $\frac{5}{8}$ in—1 ft. The brig model by Mr. Pearson is based on the model of the brig *Fantome* in the Science Museum. Two other sailing barges have been entered, one by Mr. J. Brown, of Harlesden, N.W.10, and the other by Mr. F. F. Woodruff, of Dunstable. Mr. Brown's model is ribbed and planked and is built to the scale of 7/32 in.—1 ft. Mr. Woodruff's model is to the scale of $\frac{3}{8}$ in.—1 ft. and represents the barge *Urgent*, built at Rochester, in 1877. An interesting exhibit in this section is the 6 m. Class yacht entered by Mr. R. C. Blyth, of Gerrard's Cross. The hull is built on the pre-stressed skin principle, and a portion of the skin is included in the exhibit to illustrate the method of construction. This should be carefully studied by all interested in model yachts. The schooner *Marjea* entered by Mr. W. H. Shipton, of Surbiton, was illustrated in our issue for August 11th.

Among the power-driven working models, one of the most interesting is the modern motor vessel entered by Mr. W. Wrey-Savile, of Clevedon, Somerset, who is the Chief Refrigerating Engineer of the Blue Funnel liner M.V. *Rhexenor*, and the model is his conception of the large liner of the future. Time alone will show whether he is correct or not, but certainly at the moment the tendency in ship design seems to be on these lines. The illustrations in last week's issue show this model both in action and alongside the builder's other models. She is 5 ft. 3 in. long overall and is electrically driven. Another model illustrated last week is that of R.M.S. *Andes*, of the Royal Mail Line. This was built by Mr. G. H. Yonds, of Hexham-on-Tyne, and is 4 ft. $5\frac{1}{2}$ in. long overall. The hull is of metal and was made from an old oil drum. The good proportions and nice detail work will be seen from the illustration. Mr. G. H. Davis, of Brighton, whose drawings in the *Illustrated London News* provide a wealth of information for ship modellers, sends two models, one of a modern-type cargo liner, the other of a battle



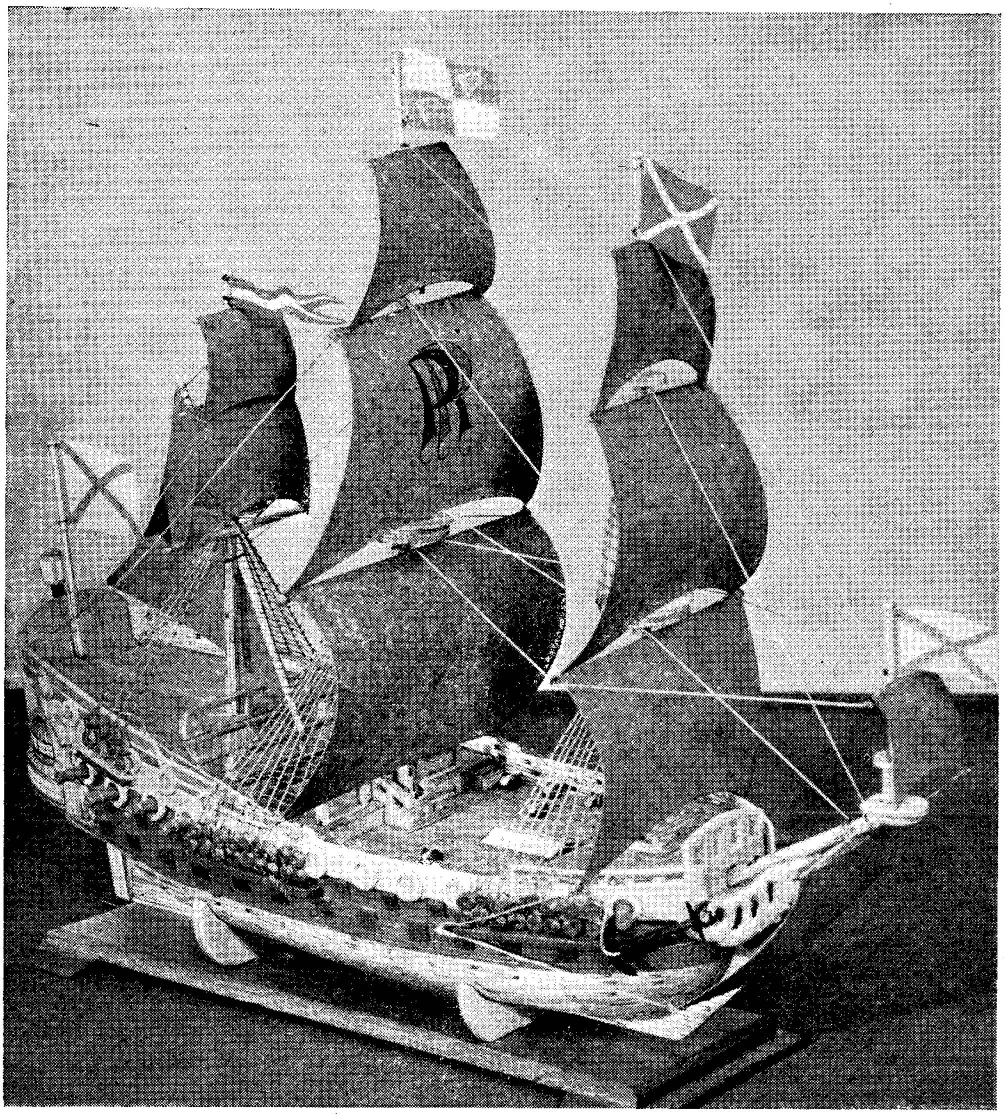
A model of the smart modern motor vessel "Port Pirie" by W. G. Beaman

class destroyer. Both are fitted with twin screws and the cargo liner is steam driven. In this model great ingenuity has been employed to provide the furnace with a good air supply without destroying the good looks of the model. Mr. S. V. Hill, of Redditch, sends a model of a large passenger liner which is an enlarged version of the *Penang* described in Mr. Sharpe's articles in THE MODEL ENGINEER during 1947. This is the builder's first model. Beginners who study the photo of it reproduced in our last issue should be encouraged thereby to persevere with the model they have commenced and bring it, as Mr. Hill has done, to a successful conclusion. Another beginner, Mr. K. G. Williams, of Bellingham, S.E.6, wisely adopted the *Penang* articles as his "words and music," and has produced a model which is to be seen at the Exhibition. He has no workshop but accumulated the necessary tools as the work proceeded, and had to improvise with a hand drill fixed in the vice when he came to a job requiring a lathe. Mr. William's model is electrically driven. Mr. W. E. Morris, of Hockley, Essex, is exhibiting an excellent model of the ocean-going salvage tug *Zwarts Zee* which at the time of her launching

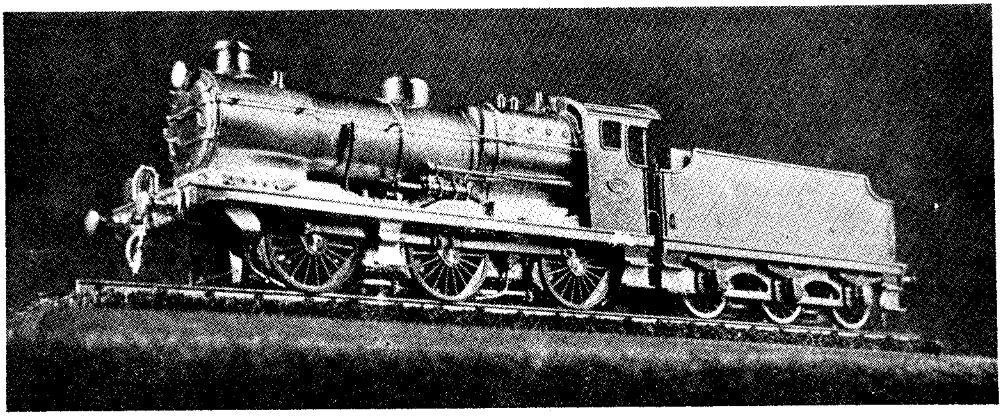


A working model destroyer by G. H. Davis. The funnel is fitted with a smoke-producing apparatus

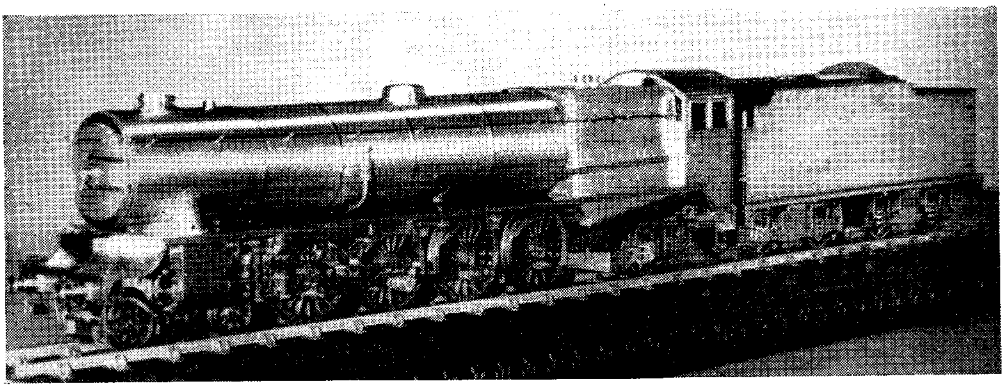
in 1933 was the largest tug in the world. The model is electrically driven and, as will be seen from the illustration published in our issue of August 11th, has a very realistic appearance on the water. The tug is always a favourite with modelmakers and at least three other examples are on view. The M.T.B. and similar high speed craft which were developed during the recent war have also become very popular with modelmakers, and several models of these craft are on view. The photo of that by Mr. B. E. Cook, of Hemel Hempstead, shows a very successful example of this type. Mr. Cook informs us that this is his first attempt at exhibition work and that owing to housing difficulties he has had to build it on the kitchen table. Mr. W Croft, of Mitcham, Surrey, is exhibiting his "M" Class destroyer model. This is powered by a 15-c.c. 4-stroke I.C. engine geared to twin screws, and is interesting on account of the general layout of the power plant. It is described and illustrated in the current issue of *Model Ships and Power Boats*. The Hydroplane and Speed Boats Section is not very well represented, only three examples being shown. One of these, exhibited by Mr. L. C. H. Sills, of Writtle, Essex, represents a Naval speed launch, and its hull has double diagonal planking with silk interlining.



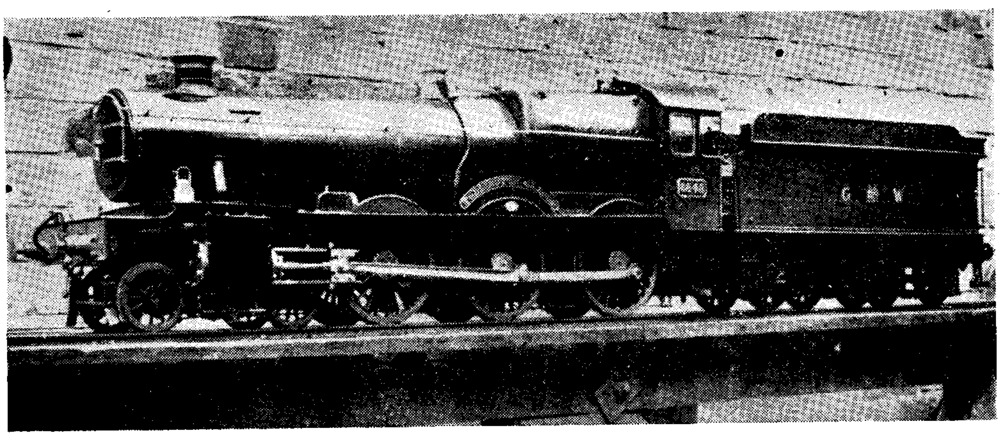
A ship model built from matchsticks by Sergt. G. R. Day



A very fully detailed " O "-gauge version of a Southern Railway " Q "-class 0-6-0 *made by Mr. E. Willsher, of Putney*

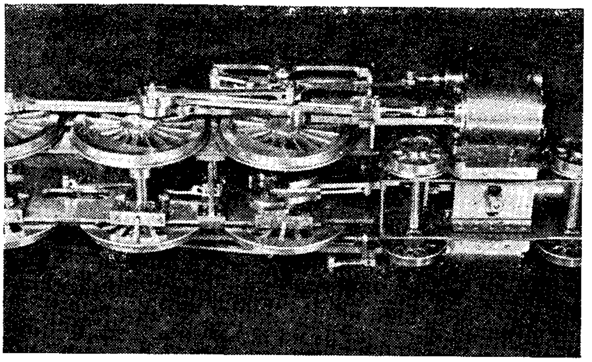


Mr. R. D. Rowell's remarkable 3*-cylinder steam* 4-8-2 *engine for " O "-gauge*



A 5*-in. gauge G.W.R.* 4-6-0 *engine No.* 6848*, " Toddington Grange " built by Mr. H. Richardson, of Cheltenham*

This is an interesting method of construction and this example should repay careful study. It seems a pity that some examples of really high speed hydroplanes illustrating recent tendencies in hull design could not have been shown, as there is considerable development in this matter at the present time.

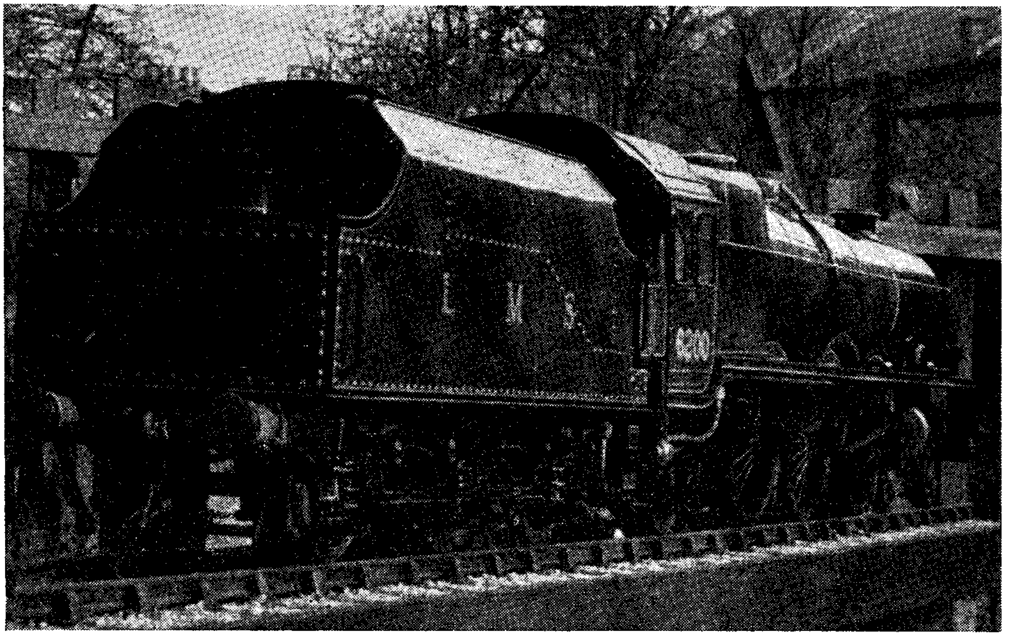

Cylinders and motion of Mr. R. D. Rowell's "O"-gauge steam 4-8-2 locomotive

Among the late entries is an exquisite example of miniature work in the model of the *Charles' Galley* of 1676, made from the original (Admiralty) draft by Capt. Wall, of Elham, Nr. Canterbury. Capt. Wall will be remembered for his lovely model of H.M.S. *Portland* which was described in THE MODEL ENGINEER during July, 1946. This, his latest model, is his first serious attempt at miniature work. The model is framed and planked and finished in correct dockyard fashion. Visitors should certainly not miss seeing it.

Apart from the models, there are three stands which should not be missed by the serious ship modeller, viz. the Ship Model Societies' stand (No. 52) and the "Ship Modelling in Progress" stand (No. 51) and the Model Yachting Association stand (No. 57). At the Ship Models Societies' stand will be seen examples of jigs and tools used in ship modelling and also some unfinished models from which much may be learnt about ways and means. At the adjoining stand, one of our exhibitors, Mr. I. W. Marsh, of Barry, will be seen actually at work on his latest model, which may, who knows, prove to be a cup winner next year. The Model Yachting Association can always be relied upon to show us something interesting in model yacht construction. Finally, one must not miss the large model brigantine which will be seen in the Loan Section. This was presented to the firm by R. C. Anderson Litt. D., F.S.A., the well-known authority on old-time ships. It has been lengthened and rerigged by Mr. Anderson and can be relied on as a valuable document on the rigging of the early 1800's.

Horological, Scientific and Optical Apparatus

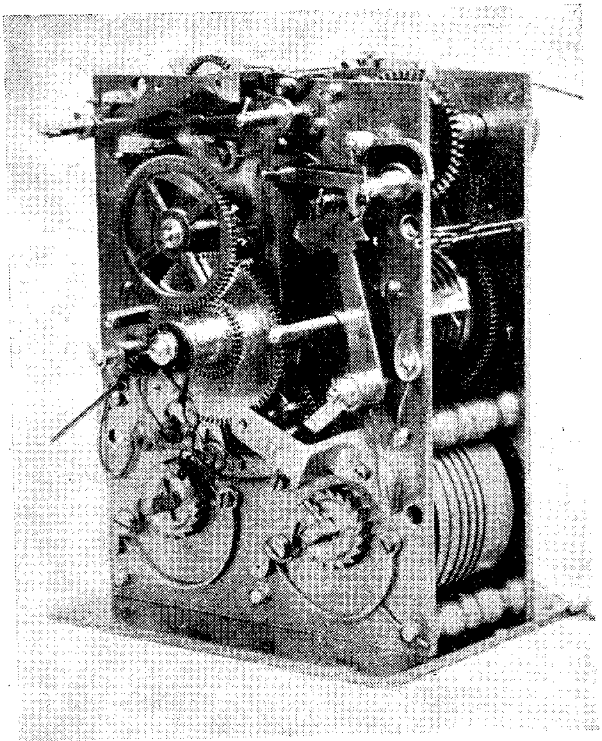
Two examples of the popular MODEL ENGINEER



Mr. Blyth's ¾-in. scale L.M.S. "Princess Royal" is just as impressive when viewed from the rear end

cine-projector appear this year, the first by Mr. I. P. Holden, of Windermere. This machine is improved in detail, being fitted with a 300-W lamp and a modified lamp house, with provision for fan cooling. It incorporates an auto-transformer in the base of the projector, for current supply to the motor and lamp.

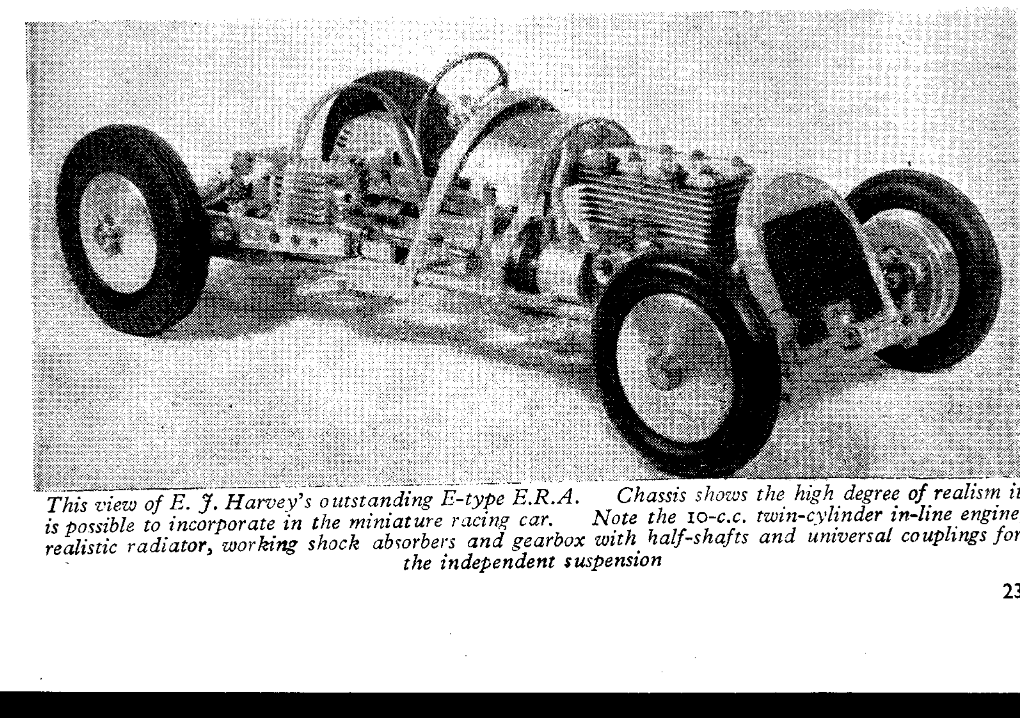
The other example, made by Messrs. A. & A. R. Kidd, of Watford, incorporates no departures from the original design, except some improvements to the lamp holder found to be desirable owing to the damage to the insulation by heat. The machine will take either 9.5 or 16 mm. film.



The movement of Mr. C. B. Reeves' miniature bracket clock

Mr. C. B. Reeve, whose clocks exhibited in previous "M.E." Exhibitions have always attracted interest and admiration, has this year contributed a miniature 17th century 8-day bracket clock, with striking train and repeating train to repeat hours and quarters. This may be regarded as a scale model of the typical English bracket clock, the motion plates being 4 in. and 3 in. containing three separate trains of 5, 4 and 4 wheels and arbors respectively. The largest wheel is only $1\frac{1}{4}$ in. diameter and the smallest $\frac{1}{2}$ in. diameter.

An example of the "Eureka" electric clock described early this year in THE MODEL ENGINEER is entered by Mr. A. E. Bowyer-Lowe, of Letchworth. The framework of the clock has been redesigned and the bearings modified, the 60-1 reduction gear and the 12-1 motion gears being of the epicyclic type, all fitted on or around the centre spindle. Mr. G. R. Haupt, of North Harrow, has entered a $\frac{3}{4}$-seconds synchronome master with modifications designed by the constructor; also incorporating chiming mechanism.



This view of E. J. Harvey's outstanding E-type E.R.A. Chassis shows the high degree of realism it is possible to incorporate in the miniature racing car. Note the 10-c.c. twin-cylinder in-line engine, realistic radiator, working shock absorbers and gearbox with half-shafts and universal couplings for the independent suspension

A 2 in. magnetic compass with jewel bearings and brass case is entered by S. G. Ackerman, of Callington. This has been made entirely from scrap, the jewelled bearings being made from old watch jewels, and the glass cut from a piece of old window-glass and ground on the edge to fit the case.

A Vickers Viking, B.E.A. "Valerie," by H. A. Gibbs, of High Wycombe. One of the outstanding flying scale control-line models on show

Mr. F. Mason, of Bury, exhibits a selection of optical apparatus, including a low-power microscope with accessories, bulls-eye condenser, stage forceps, section microtome, dissecting and slide-making stand, slide ringing and finishing table, mounting tweezers and tools in glass pocket collecting-box, samples of slips and slides, also a mirror made from two pieces of nickel-silver plate, ground and polished, and mounted on the shade ring of an electric lamp holder.

Model Aircraft

On looking over the model aircraft exhibits in the Competition Section of this year's Exhibition, one is immediately struck by the obvious trend towards realism that has taken place. In other words, there are less models of a purely functional type and more of those which are scale, or at least semi-scale, models of full-sized prototypes. This is particularly noticeable amongst the control-line exhibits where there are many outstanding examples of scale models, including a fine Vickers Viking aircraft, made to a scale of ¾ in. to 1 ft., entered by H. A. Gibbs of High Wycombe and illustrated on this page. It is powered by two E.D. MarkIII diesel engines.

Another model in this class is the de Havilland Hornet by P. Donavour-Hickie of Horley, Surrey, photographs of which appeared in our last week's issue. Despite its exhibition finish, this model has flown in a number of contests this year and has proved to have an excellent performance—even with either of its two Mills 1.3 c.c. diesel engines stopped.

Much interesting detail work has been put into a Bristol Beaufighter entered by E. J. Pithers of London, W.11, which among other features, has working navigation and landing lights, the current for which is supplied through the control lines, thus saving battery weight in the aircraft.

Models of 1914/18 war aircraft appear to be very popular with control-line enthusiasts at present, judging by the numbers of these which have been entered. Noteworthy among these is a Bristol Scout, by R. S. Martin, Seven Kings, Essex, and a Fokker DR.1 by K. E. Wilson, New Malden, Surrey.

In the class for free-flight power-driven models a Republic "Seabee" by D. A. S. Parker of Hanwell, W.7, is worthy of close inspection. For the first time radio-controlled models have been entered in this class and there are examples of the Keilkraft "Falcon" design entered by J. D. Parker, Harrow and L. Hagger, Southall, Middlesex, the latter's model having both rudder and elevator control with engine cut-out. A point of particular interest is that it features a free-wheeling propeller of the entrant's own design.

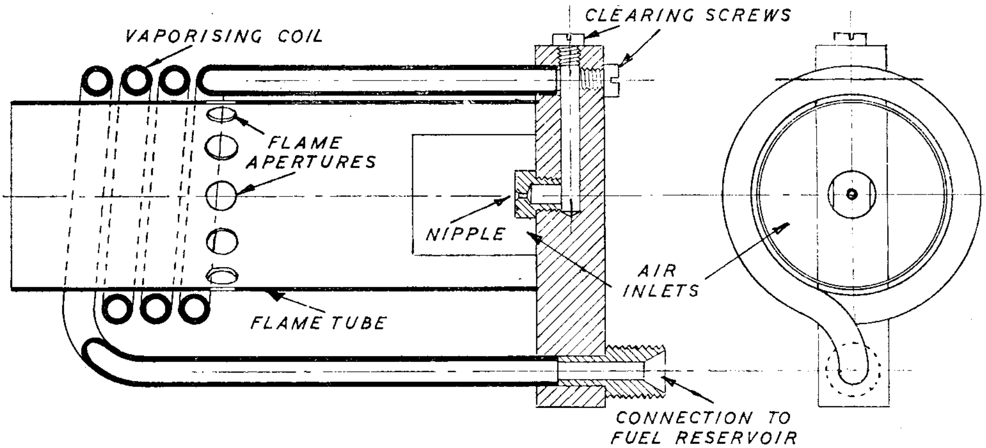
On the Society of Model Aeronautical Engineers' stand it has been the custom in past years to show models which have not been built specifically for exhibition purposes, but are holders of British records or winners of important contests. Great interest is being centred this year on the display of models which have recently competed in the 1949 Wakefield Cup International Contest and particularly in the winning model from Finland. Enthusiasts will no doubt take full advantage of this excellent opportunity of comparing the design and constructional features of the British and foreign models.

*UTILITY STEAM ENGINES

by Edgar T. Westbury

WHEN it is necessary or desirable to obtain the highest possible efficiency from a well-designed model steam plant, it is usual to employ a burner working on benzoline, petrol, or paraffin. As already explained, these fuels have a higher calorific value than alcohol, but they involve the need for more elaborate forms of blowlamps to effect their complete combustion under the particular conditions of operations. If burnt with a deficiency of oxygen, they produce bustion, the fuel must be heated to a minimum temperature not less than the boiling point of its heaviest fraction, or alternatively, atomised finely and intimately mixed with air ; the former method is in some respects the simpler, and is almost universally employed in the orthodox blowlamp.

A word as to the definition of the fuels in this class may be appropriate, and helpful to the user in selecting a suitable fuel or type of burner.



A typical example of the form of pressure vaporising burner suitable for internal-flue boilers

smoke and soot, which is not only unpleasant, but also coats the surface of the boiler flues and tubes with a non-conducting layer of carbon and thereby impairs heating efficiency very considerably. Wick lamps may be regarded as quite impracticable with these fuels, and only vaporising burners, and fairly high pressures, have been found satisfactory in general practice.

While the principle of vaporising the fuel, by the application of heat to the burner, is much the same as in spirit lamps, much higher temperatures are necessary to vaporise the fuel completely, and it is not generally considered discreet to heat the fuel in bulk, as in the " French Blowpipe."

The fuels in this class are all " compound hydrocarbons," that is to say, they are a mixed blend of several " fractions," all having different characteristics, including the temperature of vaporisation. If such a fuel is burnt in a wick lamp or other open burner, the lighter fractions ignite readily, but the heavier fractions are imperfectly vaporised and only partly consumed, resulting in the formation of carbon monoxide and solid carbon. To obtain complete com-

Benzoline is perhaps the highest grade of petroleum derivative and may be regarded as equivalent to a very volatile grade of petrol, such as is rarely seen nowadays. It may be found very difficult to obtain at present, as there are restrictions on its bulk supply, but the grade of petrol specially made for use in petrol air-gas plants has much the same properties, and will burn in practically any lamp designed for benzoline, according to my experience.

Modern petrol, or motor spirit, is definitely not intended for combustion in blowlamps, and may in some cases be highly unsatisfactory, especially if it contains lead compounds, which may cause persistent fouling of vaporiser tubes and choking of jet nipples. Apart from this, however, it will usually work in pressure-vaporising lamps and produce a very high heating efficiency, some slight modification of jet orifice and air apertures being usually necessary in burners designed for the older, more volatile fuels.

I am at present making some tests with a new blowlamp fuel produced by the High Flash Petroleum Co. Ltd., of West Croydon, which appears to be an improvement on any available fuel so far tried. It has the essential characteristics of good quality benzoline, being highly volatile,

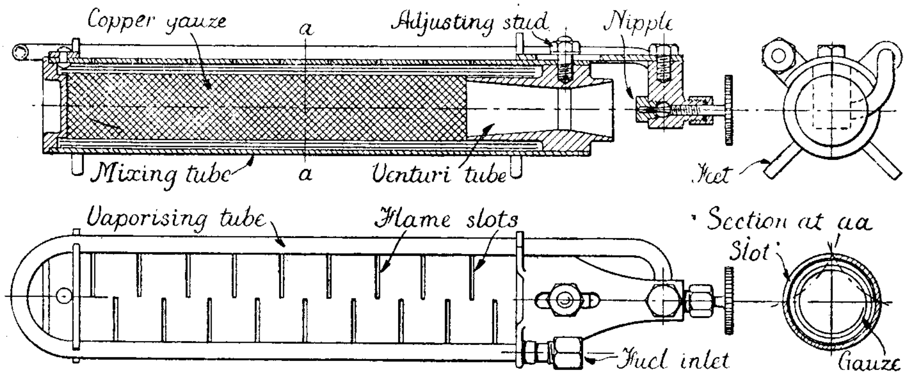
*Continued from page 186 "M.E.," August 11, 1949.

and clean in use, burning in all types of self-pressurising or pump-charged blowlamps with a notable absence of smoke or smell, and very little tendency to choke the vaporisers.

Paraffin (or kerosene) also has a very high calorific value, and when properly used, is generally better than petrol in this respect; but it has a very high vaporising temperature, and any shortcomings in the vaporiser will interfere with complete combustion. Moreover, it is commonly condemned as a "dirty" fuel, due to the fact that some carbonisation of the vaporiser is almost inevitable at the high working temperature, and nipples require frequent attention. Many blowlamps designed for paraffin are used with petrol to avoid this trouble, the only alteration necessary being slight enlargement of the nipple orifice. It may, however, be placed on record that there are many model steam plants working successfully on low-grade paraffin, and in some cases still heavier fuels, such as creosote or fuel oil, have been burnt successfully in vaporising burners.

Some burners of this type are self-pressurising, the heat of the burner being conducted to the closed fuel reservoir in sufficient measure to cause some expansion of the contents, and thereby produce a sufficient pressure for feeding the burner at the required rate. It is obvious that this works best with the more volatile fuels, so that the principle is quite common with benzoline lamps—very well-known examples being the early Paquelin lamp used by painters and plumbers, and the more modern Barthel lamp for similar purposes—and rarely successful with paraffin. In any case, the maximum rate of combustion can only be obtained by artificial application of pressure to the fuel, generally by pumping air into the fuel container. The well-known Primus system of fitting an air pump in the fuel reservoir is often used for the blowlamps of model steam plants, but where bulk and weight are important, it is usual to dispense with a built-in air pump, and simply fit a valve and screwed connection to the filler cap of the tank, so that a cycle pump can be used to supply the required air pressure. These arrangements are so well known to most model engineers that they do not call for detailed explanation.

Nearly all pressure vaporising burners are modifications of the "regenerative" or self-heating Hjorth burner, which has been universally employed in industrial paraffin blowlamps for many years. In this device, a hollow vaporising element is placed inside the flame tube, and in the path of the flame; the fuel, on its way to the jet nipple, passes through this element and is heated sufficiently to become completely vaporised. The standard commercial blowlamp burner can be adapted in its entirety to the purpose of firing a boiler, and the same applies to the Primus vertical burners, both the "Silent" and "Roarer" types being suitable, though these often take up more furnace space than can be allowed in a small plant. Smaller versions of these burners, for both horizontal and vertical flame, have been produced, the well-known "Torid" burners being a typical example, and somewhat similar burners are made by British Industrial Model Services, Bournemouth, and the Imperia Co., Ilford.



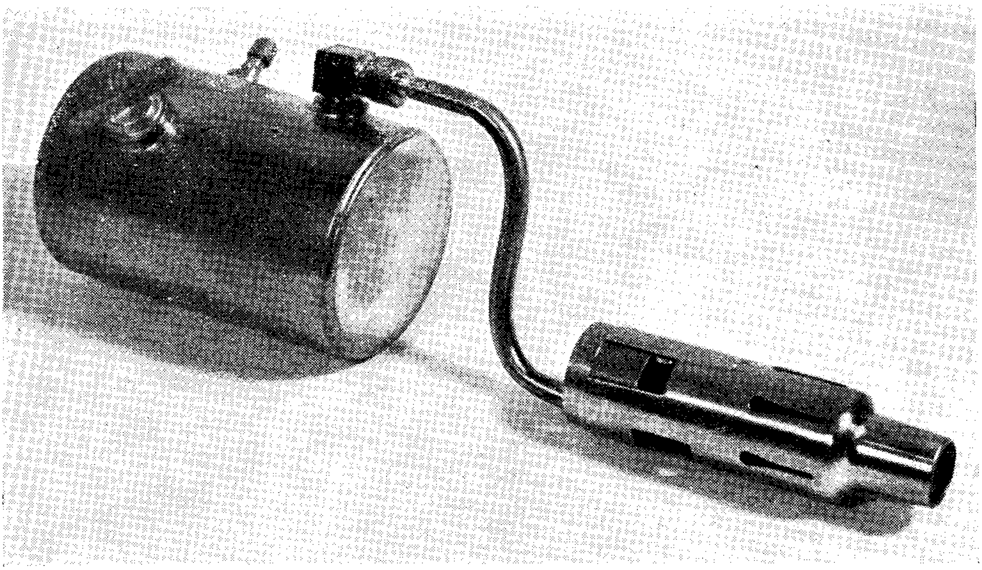
A diffused flame pressure vaporising petrol burner

Most amateur-constructed vaporising burners avoid the use of the internal vaporiser element, which is difficult to make, and even more difficult to clear if it becomes carbonised; using instead a coiled tube for the vaporiser and locating it outside the flame tube. It works at a lower temperature in this position, and is less liable to carbonisation, while its lower heating efficiency is compensated by the increase of heating surface, the length of tube in the coil being adjusted as found desirable; generally about four turns are found sufficient. There is, however, no universal agreement in this matter, and lamps with as many as a dozen turns in the vaporising coil, or as few as two, have been encountered. The heating of the coil can be improved by making flame apertures in the flame tube, their number, size and location being a matter for experiment; many constructors however, say the lamps work better without any flame apertures at all.

In some cases the flame tube is tapered, or otherwise reduced in size at the discharge end to increase flame velocity, but parallel flame tubes

are most common, and generally found satisfactory in practice.

The jet nipple, which may be of the Primus type, is usually fitted to a bar of brass or steel which passes across the back of the flame tube, and to which the vaporiser tube is brazed. In some cases an adjustable needle-valve is fitted to the nipple, or alternatively, a control or stop valve is fitted to the fuel reservoir.



A paraffin blowlamp with " torch " type of burner, by the Imperia Co., Ilford

The flame tube is usually of iron or steel, and may be made readily detachable. It may be equipped with means of regulating the size of the air inlet apertures, but generally the policy is to provide the maximum possible area for unrestricted air flow, both through the side openings and at the back, on either side of the nipple bar. Copper tube is commonly employed for the vaporiser, but some users report that less trouble is encountered with choking when steel tube is employed. When the burner becomes carbonised, the usual course is either to renew it entirely, or to detach it and straighten it out so that a wire " searcher " can be passed right through. The fitting of clearing screws at angles in the passage, where carbon may lodge, is obviously a discreet provision, but the screws must fit closely and make good face contact under the heads to avoid gas leakage. Burners made of non-ferrous metal may be readily decarbonised by heating them to redness and passing a stream of oxygen through them; but this method is disastrous in a steel burner.

The illustration reproduced here is typical of the form of burner made by amateur constructors, for use with boilers of the internal furnace or flue type, and the orthodox coil type of flash boiler. Whatever design of burner is employed—even when an attempt is given to supply accurate dimensions of all essential parts—some experiment is nearly always necessary to obtain the best results, with the particular fuel available.

Diffused Flame Burners

In water-tube boilers, and other types in which the main generating surfaces are above or surrounding the furnace, the direct flame or torch type vaporising burner does not work to its best advantage, though it is often used more or less successfully. A form of burner which works at less intensity, but with a larger volume of flame, so disposed as to impinge directly on the generating surfaces and avoid the injection of cold air into the furnace, will produce a much higher heating efficiency in relation to the amount of fuel consumed.

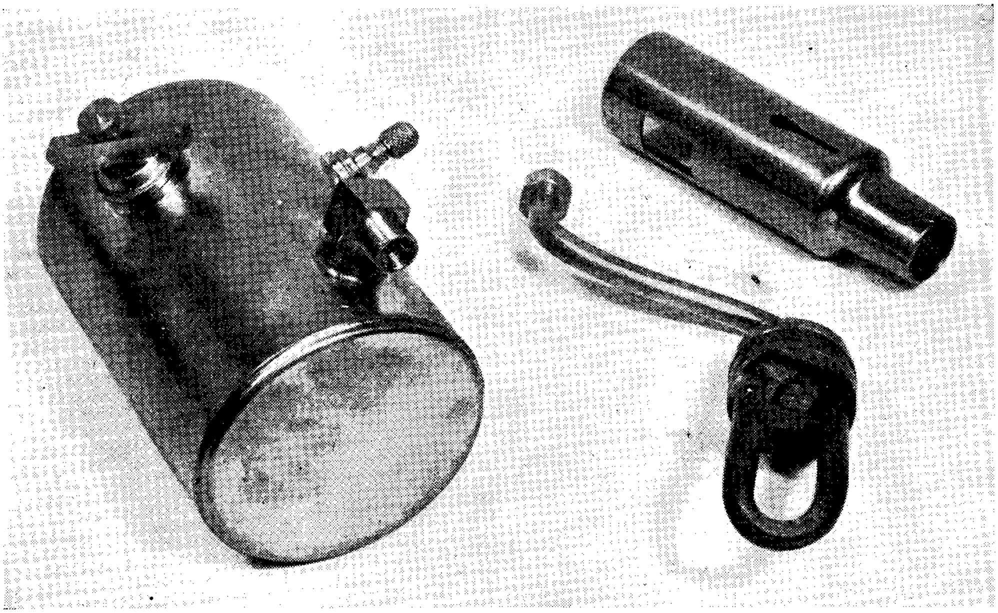
Burners of the " diffused flame " type have been used with great success in many widely different types of model boilers, including locomotives, though for some reason there seems to be a reluctance to give them a fair trial in model power boats. Speaking from personal experience, I have obtained better steaming with this type of burner than any other, and have no hesitation in recommending it.

The principle on which this burner operates is identical with that of the normal torch type, in respect of the vaporisation of fuel, and the use of a pressure jet to inject it into the air stream, thereby mixing it with air so as to produce a bunsen burner characteristic; it differs only in the way the flame is broken up in a mixing tube, and diffused in a number of flame jets over a large surface area, instead of being burnt in a single highly intense flame in a plain flame tube. The fuel vapour, on emerging from the nipple, is injected into the mixing tube, preferably by way of a venturi nozzle, which enables a high air velocity to be obtained, thereby improving the

mixing of air and fuel. A roll of coarse gauze or metal " wool " inside the mixing tube will assist the distribution of the air-gas mixture, at greatly reduced velocity or pressure, to the multiple flame jets. Only a comparatively small area of vaporiser tube is required, a single U-shaped piece being adequate, and it has been found best to make this of steel, as on one or two occasions a copper vaporising tube has been completely melted out.

Atomising Burners

The prime essential condition in the complete combustion of any form of fuel is that every particle of it must be brought into contact with a sufficient quantity of atmospheric oxygen at the moment of ignition. Various methods are employed to this end, according to the fuel and available facilities ; in the vaporising forms of burners, the liquid fuel is first gasified, and thus mixes readily with air, assisted by the high



The Imperia blowlamp dismantled, showing the loop vaporiser, which is bent sideways out of the direct path of the flame

In the burner illustrated, the apertures in the mixing tube are in the form of slots, but small round holes are also practicable, a large number, well distributed, being usually found better than a small number of larger holes. If a venturi mixing tube is used, the position of the jet nipple, relative to the throat of the tube, should be made adjustable as shown, to enable the maximum injector effect to be obtained.

There are many possible variations of both the torch and diffused flame types of burners, but it is not proposed to describe these in detail, as sufficient has been said about them to give a sound basis for construction and development. As in all other components of model steam plants, there is considerable scope for experiment in these devices, and the very last thing I wish to do is to reduce them to a series of stereotyped designs which would exhaust all possibilities, and deter further research. The true model engineers—and certainly the most successful ones—are always individualists, and once having been given a lead as to correct principles, can be relied upon to work things out for themselves ; moreover, they will derive considerably more satisfaction by adopting this course than by following blindly a rigidly set design.

pressure and velocity of the vapour jet as it is injected into the flame tube or mixing tube. The same effect can be produced by spraying the liquid fuel mechanically into the air stream, so long as the degree of atomisation is sufficiently fine to effect the necessary intimate contact with air. This avoids the necessity of heating the fuel, with its attendant troubles of carbonisation and imperfect vaporisation, and enables much heavier fuels to be consumed than would otherwise be possible. It may be said that for burning large quantities of low-grade liquid fuel, mechanical atomisation is the only really practicable method.

The application of similar methods on a very small scale, however, although by no means impossible, is not nearly as simple as it may appear, and many experiments in this direction have produced disappointing results. One of the major problems encountered is that of dealing with sufficiently small quantities of fuel, which makes it almost impracticable to use sprayers working on purely mechanical principles, i.e., by forcing fuel through fine orifices under directly applied pressure. It would be extremely difficult to produce sufficiently fine spray orifices,

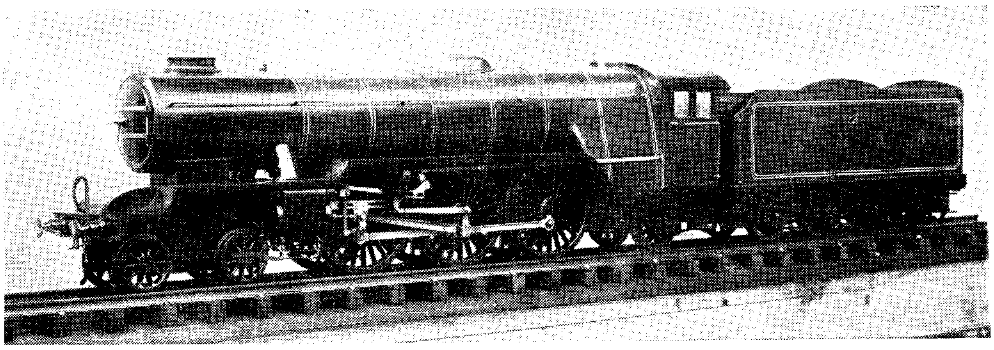
(*Continued on page* 251)

"And See What Toucan Do"

(With apologies to Guinness !)

by "L.B.S.C."

YOUR humble servant has received many letters of appreciation from locomotive builders who have completed a "Hielan' Lassie" engine, and been delighted with the way it performed ; but I must confess to feeling frankly astonished when a correspondent of many year's standing, wrote to tell me he had built *two* of them—"twins," in very truth ! the Maunsell three-cylinder 2-6-0's of the old Southern, pass here every day, and the beats are invariably even. One has just gone by, with 45 wagons and a brake, going up the 1-in-264 and with the radius-rod very nearly in the middle of the link, with absolutely even beats. It may well be that the valve settings on the two "Lassies" are not exactly alike.



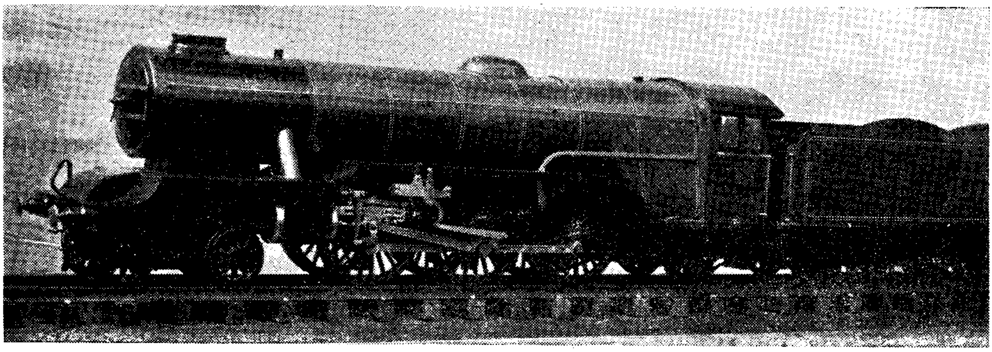
No. 1 "Lassie" with Walschaerts gear and piston-valves

However, it is a fact, and this is how it came about. A Bucks reader, Mr. N. Daintree, started on "Lassie No. 1," and thought he would have a shot at piston-valve cylinders ; but owing to his adjustable reamers not making a perfectly parallel bore, he had no end of a job to get the bobbins to fit correctly without blowing. After much work, he managed to get them O.K. by the use of adjustable lead laps, to finish the liner bores. Meantime, thinking that the piston-valve job might not come up to expectations, he started on another engine, "Lassie No. 2," this time fitting slide-valves and Baker gear. Both engines were duly completed, and then our friend got a bit of a shock ; for lo-and-behold, the engine with the piston-valves proved to be the better of the two !

Mr. Daintree says, however, that he doesn't think it is all to do with the type of valve. The piston-valve engine has Walschaerts gear (three sets) and inside admission, and the slide-valve engine has Baker gear and the two-to-one conjugation. The middle cylinder is a little "off beat," and he thinks this may probably account for the milk in the coconut. Personally, I wouldn't like to say definitely ; there are so many little things which might upset an engine's performance, some of them very insidious. In passing, I have never yet heard an engine with three cylinders and the Gresley two-to-one gear, give six perfectly even beats per turn ; *per contra,*

Our worthy friend says that he built up the boilers from sheet copper, rolling up the barrels, and carried out the brazing according to my notes, using an oxy-coal-gas blowpipe ; one was 13-gauge, and the other 14-gauge, as the former was not available when the second one was built. The job panned out all right. He also mentions that he saw a "Lassie" chassis, built by a well-known professional, which was fitted with two eccentric-driven pumps. On inquiring the reason, he was assured that one pump would not be sufficient to maintain the level ; so on the strength of that, he fitted two pumps to one of the "Lassies," only to discover for himself that the solitary pump I specified, was ample. Not only so, but it was the smaller of the two alternatives given in the instructions ! Thus does experience teach. However, as I happen to know how the builder of the before-mentioned chassis sets his valves, I can also fully realise why he finds it necessary to fit two pumps. There is a great deal more than would appear, in valve setting, as the few good folk who have driven my engines "Grosvenor" and "Jeanie Deans," can testify.

Since completing the "Lassies," Mr. Daintree has also built a "Doris," a photograph of which is reproduced here. The piston-valves on this engine were made and fitted according to the experience gained with the "Lassie," as mentioned above ; and the valves are O.K. The



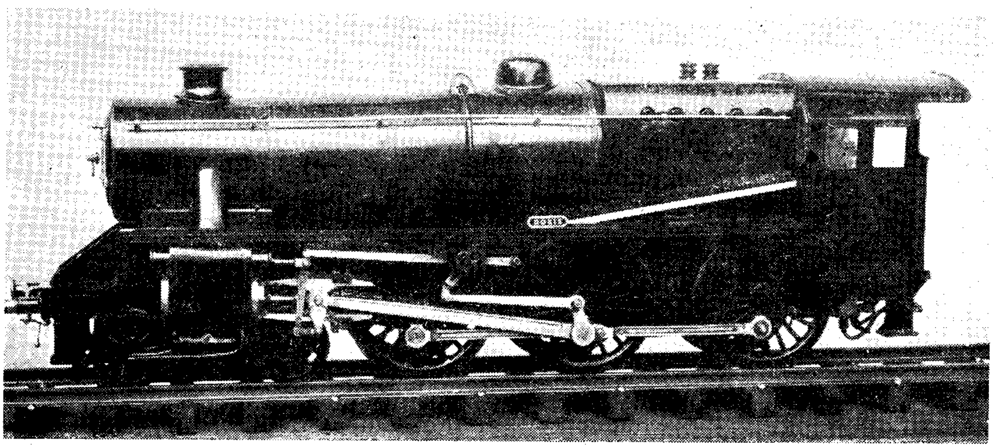
No. 2 "Lassie" with Baker gear and slide-valves

engine is built to specification, and does the job in the approved manner, so no more need be added. Our energetic friend has also built a "Petrolea," which comes up to expectations, but she is not yet painted, and the photograph of her is rather too "misty" for reproduction. She certainly looks a very fine and realistic job. In offering hearty congratulations to Mr. Daintree on his fine efforts at locomotive-building, I would also like to thank him for his kindly appreciation of my instructions and drawings.

Beginners' Corner (continued)

Before proceeding to erect the frames for "Tich," the jaws of the hornblocks must be cleaned up all ready for fitting the axleboxes. Now to ensure that the axleboxes are exactly opposite one another, the obvious thing to do, is to bolt the frames together and clean out each pair of hornblock jaws at one fell swoop; so we will proceed to do that. Put the frames together in the way the kiddies would call "inside out"; that is, with the hornblocks outside, and fix them together temporarily with a couple of screws and nuts put through the holes at each end.

I don't suppose there are many beginners who own a milling machine; but any lucky person who does, wouldn't need detailed instructions on how to mill out the hornblock jaws, as all that is needed, is to catch the frames in the machine-vice, and run them under a suitable end-and-face milling cutter mounted on the arbor. Probably there may be a few who own a planing or shaping machine; in that case, the frames are mounted in the machine-vice, and a bent tool in the clapper box, fed downwards, will clean out the sides. The bottom is cleaned off with a straight tool. However, there is really no need for machining at all, as the humble but necessary file will do the job quite well, if the operator exercises just ordinary care. You will need a gauge; this is simply a piece of $\frac{5}{8}$-in. square bar about $1\frac{1}{2}$ in. long. Grip the frames in the bench vice, end-up, with the hornblock as close to the vice-jaws as possible; then, with a wide, flat second-cut file, held horizontally, smooth off one side of the jaws, taking off about 1/32 in. Now turn the pair of frames up the other way, and repeat the operation; but this time, try your piece of bar in the opening, and continue filing, very carefully, until the piece of bar is an exact fit in the horn-



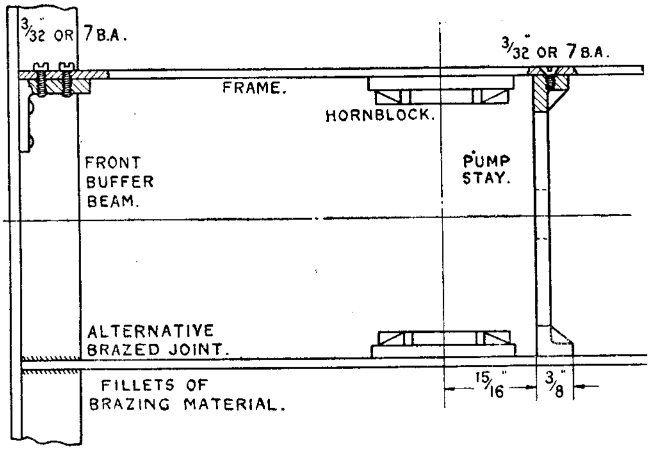
Mr. Daintree's "Doris"

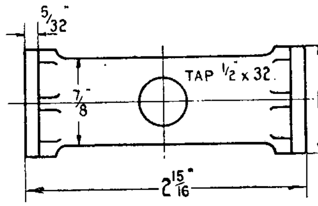
block jaws, sliding in easily to the full depth, but without any appreciable shake. Then turn the frames horizontally in the vice, and clean out the ends of the jaws ; no gauge is, of course, needed for that. The axleboxes, when fitted, should now be dead in line, each with its opposite mate on the other side of the frame, if same is erected properly.

How to erect frames

Part the frames again, then put the ends in the two slots in each of the buffer beams. See that the frames go right to the ends of the slots, so as to form a perfect rectangle ; the frames must be exactly at right-angles to the beams. This can be checked by applying your try-square. The top edges of the frames, and the tops of the beams, must all be what engineers call " in the same plane," that is, perfectly level ; and this state of affairs can be achieved in two wags of a happy dog's tail, simply by laying the whole bag of tricks upside down on something true and flat, such as the lathe bed, and pressing both frames and both buffer-beams into contact with it. Hold them thus, by any means available ; personally, I use a toolmakers' cramp at each corner, placed over frame end, and the angle attached to buffer beam. For those with shallow pockets there is not the slightest need to buy the cramps ; they can be home-made in a few minutes apiece, as shown in the illustration which needs no explaining. They can be made in any size.

To fix the frames to the angles, run the No. 40 drill into all the holes in the ends, using the hand brace, and made countersinks on the bits of angle. Follow up with No. 48 drill, then tap the holes with either a 3/32-in. or 7-B.A. taper tap. Work same backwards and forwards, using some cutting oil on the threads. At present, the cutting oil I use is Edgar Vaughan's " Cutmax," diluted with one-third its bulk of common paraffin ; but any good cutting oil available can be used. Warning to those who haven't used small taps in steel : *don't* use a big tap-wrench, and *don't* force the tap. As soon as it tries to stop, " reverse engines " and turn backwards half-a-turn or so. No sense in wasting money when it can be avoided, and it is fairly expensive to replace broken taps. When you have tapped the three holes in one corner, put the screws in before you do any more drilling and tapping ; then check the frame to see that it hasn't got " out of plumb." If it has shifted, reset it before proceeding.





Above—Pump stay

Left—How to erect " Tich " frames

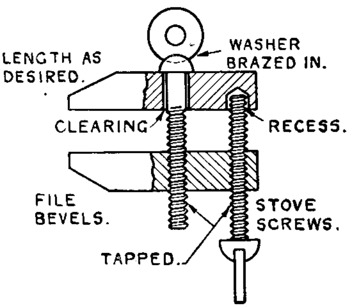
Beginners often write and ask why I don't stick to fraction-size drills, $\frac{1}{16}$-in., 3/32-in. and so on, instead of giving numbers. Well, it is for the very simple reason that there is too big a jump between fraction sizes, for many of our jobs ; one size would be too small, the next too large. For example, a 3/32-in. pin would flop about in a 7/64-in. hole, and such " fitting " would be useless for valve-gears. In the number sizes, there are six drills between 3/32-in. and 7/64-in., viz. 41 to 36 (the bigger the drill, the lower the number) and the No. 41 drill is the exact clearing size for a 3/32-in. pin. Number drills are as readily obtainable as fraction drills. Beginners should, if possible, buy a complete set 1 to 60, and a few extra of the most commonly used sizes—55 and 51 for $\frac{1}{16}$-in. or 10-B.A. tapping and clearing ; 48 and 41 for 3/32-in. or 7-B.A. ditto ; 40 and 30 for $\frac{1}{8}$-in. or 5-B.A., and so on.

Ordinary cheese-head steel screws can be used to hold the frames to the buffer-beam angles ; apart from the fact that they are out of sight, a full-size Chief Mechanical Engineer would not hesitate to use the most handy and suitable screws for his engine, and if he thought cheese-heads would do, in they would go. Actually, there are plenty of slotted screws in many full-sized engines. When all the screws are tight, the frames should be true and rigid ; they will be more rigid still, when the pump stay has been fitted.

How to make up a brazed frame assembly

For years past, I have brazed, or Sifbronzed all my frames to the buffer beams, entirely dispensing with screws; and welding is now used in full size, to a large extent. If any beginner wants to braze up his frame assembly, the job is easy. As previously mentioned, no angles are needed on the buffer beams; the frames are jammed into the plain slots and the whole job levelled on the lathe-bed or other flat surface, as described above. The assembly wants to be firmly held in position for the brazing job, because if anything shifts, the frames will be out of level, and useless. I hold mine in the following way:—

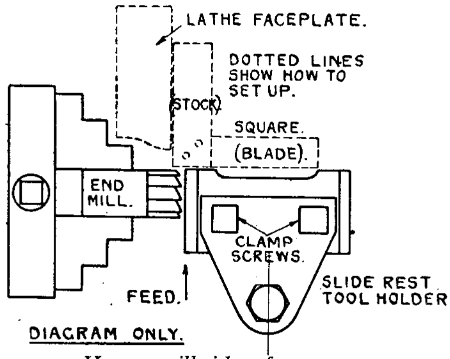
When the job has been levelled up, whilst it is still lying on the lathe-bed or other flat surface, a distance-piece, or spacer the exact width between frames, is placed between them, and a big cramp (a carpenter's cramp would do) placed over the lot and tightened up. If the frames are long, I use two spacers and cramps, one at each end. To prevent the beams moving, some iron wire is wound right around the lot, and the ends twisted together. All four corners are then given a dose of wet Sifbronze flux, and the assembly placed



Home-made toolmakers' cramp

upright in the brazing-pan, which need only be a big tin lid, or an old tea tray, or even the lid of the domestic ash-bin, if nothing else is available. You won't hurt it! Bend a bit of sheet-iron, about 9 in. wide, into a half circle, and stand it in the pan; this prevents the coke or breeze falling off the back, and provides a rest for the frame assembly to lean against. I use an oxy-acetylene blow-pipe with a small "tip" or nozzle in it (say 150 litre), and the flame from this heats the joint to bright red in a matter of seconds. The end of a Sifbronze rod is applied to the joint, in the flame; two or three drops melt off it, flow into the joint, leaving a nice fillet, and the job is done. It is far easier than soldering up a leak in the domestic kettle.

I don't expect many beginners will have an oxy-acetylene blowpipe, but they should have either a paraffin blowlamp, or an air-gas blowpipe operated by a fan or bellows, and this will do the job. The only difference is, that the flame isn't concentrated enough to heat just the joint only; you'll have to heat up the whole buffer beam to red. Use easy-running brazing-strip, which can be purchased from our advertisers, or any tool merchant. The best flux to use, is Boron compo, a blue powder sold in tins of 1 lb. and upwards. Mix some to a paste with water, and put a good smear over each joint. Then heat the beam to bright red, and apply the stick of brazing material to the joint; if a little doesn't melt off and run into the joint, it isn't

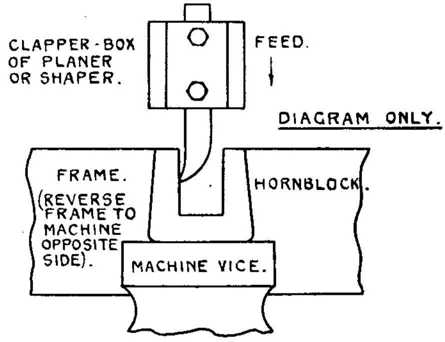


How to mill sides of pump stay

hot enough. When the melted metal has run in and formed a nice smooth fillet, give the other beam a dose of the same medicine. Then let the whole issue cool to black, finally quenching in water, and removing all traces of burnt flux with an old file.

Frame stay

To support the frames, a cross stay is fitted just behind the leading hornblocks, and as it serves a double purpose by carrying the boiler feedpump as well, it is usually known as the pump stay. It may either be a casting, or bent up

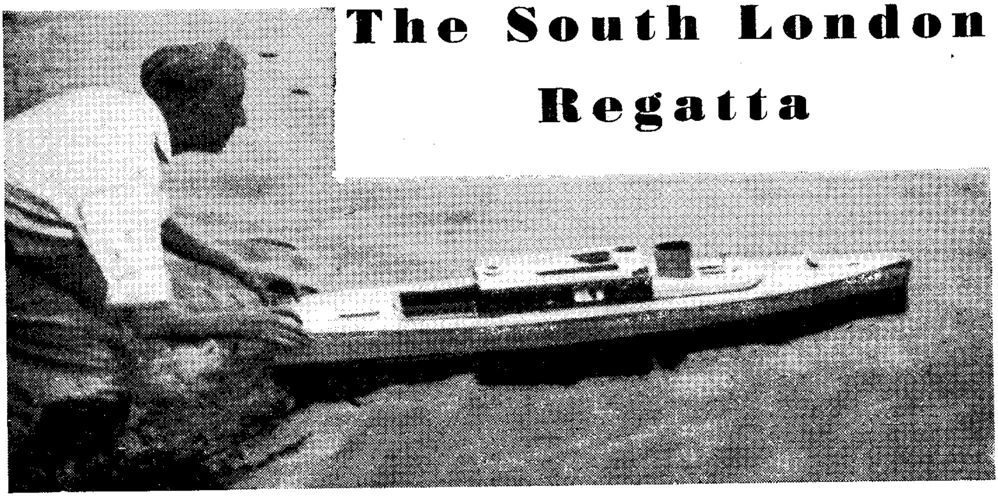


One way of machining hornblock jaws

from a piece of $\frac{1}{8}$-in. brass plate. Our "approved" advertisers can supply suitable castings. The ends will require machining off to fit between the frames. This can be done by clamping the casting under the lathe tool-holder, and traversing across an end-mill, or slot-drill, held in the three-jaw chuck. The illustration practically explains itself. To set the stay right for machining, put

(*Continued on page* 257)

The South London Regatta



Mr. Hood, of Swindon, with his steam launch "Truant," which has had a long record of success in steering events

THE annual regatta of the South London Model Engineering Society, held on July 24th, at Brockwell Park, S.E., produced a good turnout of boats and competitors, despite the fact that the International had been held the previous weekend! The speed craft, however, behaved reasonably well in their events, although the smaller boats had difficulty in completing the course.

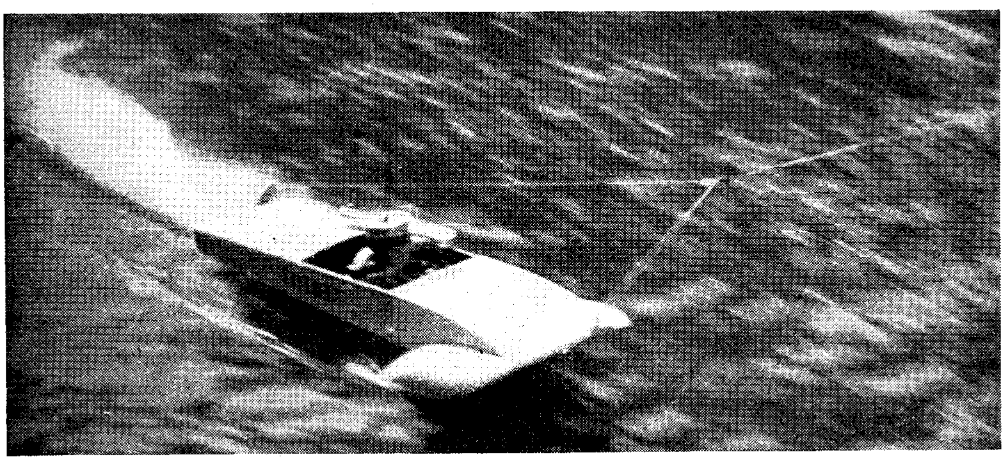
Due to the local regulations, the speed events were run off in the morning period and straight-running and prototype boats were left to the afternoon before showing their paces. The first event, therefore, was a 500 yd race for Class "C" boats.

In this race, six competitors entered and, sad to relate, none succeeded in completing 500 yds. before engine failure stopped the run, this happened on both attempts, so in order to get a result each boat was given another attempt, and this time four succeeded in completing the course. The best performance was put up by Mr. B. Miles, whose boat was timed at 25 3/5 sec.; the other three boats, owned by A. Weaver (Victoria), A. Sherwood (Victoria) and J. Benson (Blackheath), returned times within 1 sec. of each other, round about 29 m.p.h.

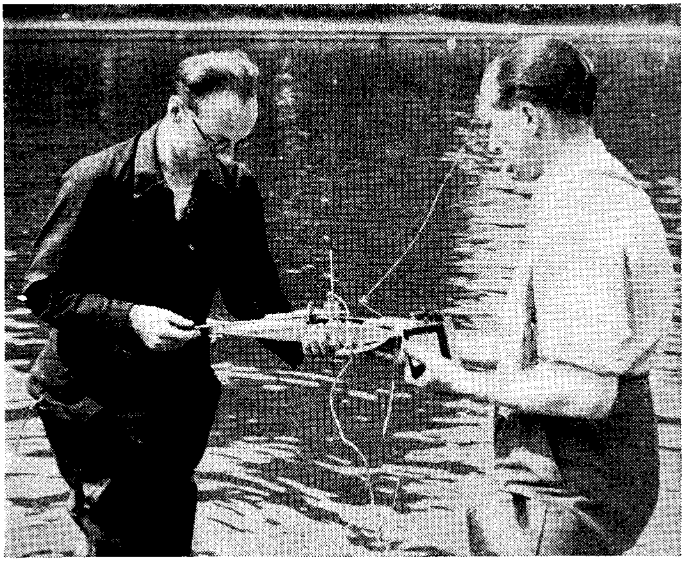
Result :—

1st, Mr. B. Miles (Malden), 25.6 sec., 40 m.p.h.
2nd, Mr. A. Weaver (Victoria), *Wizard of Oz*, 35.8 sec., 29 m.p.h.

The 500 yd. race for Class "B" boats followed, and proved to be a duel between Frank Jutton's flash steamer *Vesta II* and Mr. G. Lines' 15 c.c. two-stroke engined boat *Sparky*.



Mr. G. Lines' "B" class boat "Sparky" at full speed



The smallest boat in the regatta, Mr. Sherwood's 3.5 c.c. "Jinx," put up an excellent performance in the "C" class event

In this race, both these craft exceeded 40 m.p.h. but *Vesta II* seems slightly slower since being repaired after a recent crash, and *Sparky*, on its first run, achieved 42.6 m.p.h., which won the event.

Result :—

1st, Mr. G. Lines (Orpington), *Sparky*, 23.8 sec., 42.6 m.p.h.

2nd, Mr. F. Jutton (Guildford), *Vesta II*, 24.6 sec., 41.5 m.p.h.

The last of the speed events, a 500 yd. race for the "A" Class boats showed the International Class "A" winner, Mr. B. Miles again exceeding 50 m.p.h. with his twin supercharged four-stroke engined boat. Mr. Miles is now using glow-plugs with success in this engine.

Of the other boats in the race Mr. Walker's *Gilda* (Malden) is not very happy since being fitted with a new cylinder and inclined-valve head, the speed having dropped, and Mr. Parris (S. London), with *Wasp*, is also having a sticky patch in recent regattas, but managed to take second place on this occasion.

Result :—

1st, Mr. B. Miles (Malden), 20 sec., 51.1 m.p.h.

2nd, Mr. Parris (S. London), *Wasp*, 34 sec., 30 m.p.h.

After a well-earned lunch interval came the turn of the prototype boats, which took part in a nomination event, steering competition and a relay race.

The first of these to be run was the nomination race, about 25 boats taking part over a course of approximately 50 yds. Most of these ran very sedately and fairly straight, although some of the smaller boats fitted with c.i. engines careered about in semi-circles, these latter boats belonging to junior members experiencing their first regattas.

Result :—

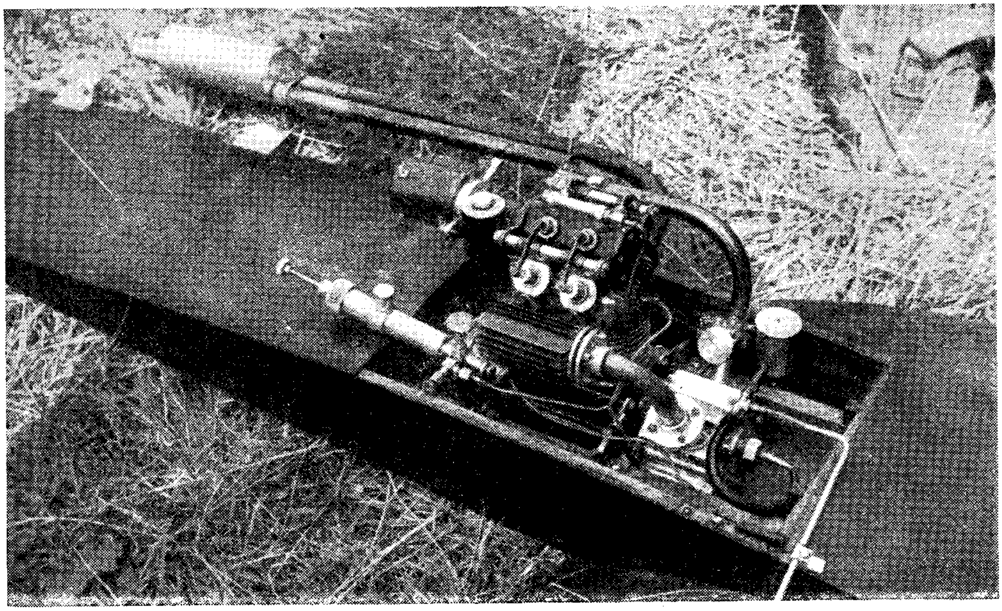
1st, Mr. E. Vanner (Victoria), *Leda II*, Nominated sec. 13, Actual sec. 12.8, Error sec. 0.2 ; 2nd, Mr. A. Rayman, (Blackheath), *Yvonne*, Nominated sec. 7.5, Actual sec. 7.2, Error sec. 0.3 ; 3rd, M. Gable (Orpington), *Piccolo*, Nomination sec. 25, Actual sec. 25.4, Error sec. 0.4.

The steering event followed. Messrs. Curtis and Rayman tied for first place and two re-runs were necessary to decide the eventual winner.

1st, Mr. A. Rayman (Blackheath), *Yvonne*, 6 pts. + 2 + 3.

2nd, Mr. F. Curtis (Kingsmere), K.M.I., 6 pts. + 2 + 2.

Intense concentration is registered by the timekeepers, Messrs. Davidson and Rowland. The electrical timing and lap-counting mechanism is seen in the photo



The twin-cylinder overhead camshaft supercharged engine of Mr. Miles' "A" class boat

Teams of three boats representing South London, Swindon, Blackheath, Victoria, and Orpington, took part in the relay race. Each boat in a team had to carry a baton across the lake and back, returning the baton to the timekeeper, when all three boats had fulfilled these conditions.

This race always causes great hilarity and excitement whenever on the programme. The winners were the Blackheath team, taking 1 min. 38 sec.—about 30 sec. ahead of the Swindon team, which took second place.

UTILITY STEAM ENGINES

(*Continued from page* 244)

and if made, they would be liable to choking by the smallest particles of solid matter in the fuel.

In a small pressure vaporising burner, a single jet orifice of about 0.008 in. to 0.015 in. diameter is employed, and this discharges the fuel, not in liquid but gaseous form, so that the rate of actual fuel discharged is reduced in proportion to the increase in volume caused by vaporisation. As anyone who has turned on pressure to an insufficiently heated burner will realise, the amount of liquid fuel it will discharge is quite out of proportion to actual consumption, and moreover, it issues from the single orifice in a solid jet, which does not conform to the essential conditions of good combustion. We may take this as lesson No. 1 in the design of atomising burners; it indicates that we must either use a much finer and more complex form of pressure jet, or one subjected to much lower discharge pressure, in which atomisation is effected by other than mechanical means.

The latter is the better method for the small burners under discussion and again gives the choice of two alternatives; one being to draw air at low pressure and high volume over a suction jet aperture, equivalent in principle to that of a petrol engine carburettor, and the other to use a much smaller volume of air or steam at relatively high pressure, in an injector type of atomiser, equivalent in principle to a "spray gun" as used for applying paint. The former method, while basically the simpler, and perfectly satisfactory in practice, involves some difficulties, or at any rate complication, in a small steam plant. It is highly satisfactory in an internal combustion engine, because the engine itself provides an air pump to draw the air past the jet; but in a steam plant, it would be necessary to provide an extra pump, blower or fan for this purpose. With the latter method, however, the possibility of using steam as an atomising medium very much simplifies the apparatus required, and has been applied with fair success to several steam generating plants of the size with which these articles are concerned.

(*To be continued*)

IN THE WORKSHOP

by "Duplex"

*44—Gear-cutting in the Lathe

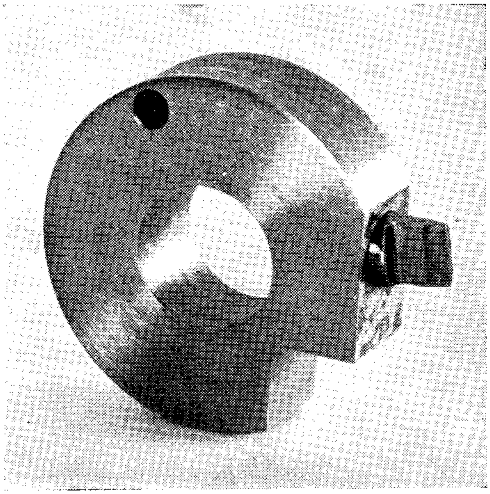


Fig. 43. *Fly-cutter mounted in circular carrier*

THE methods employed for mounting and driving the small circular gear-cutters made in the workshop were considered in the previous article, but reference to an additional feature commonly found in commercial cutters should not be omitted; that is to say, the presence of a keyway to enable the cutter to be positively driven by a key fitted to the cutter arbor.

Mounting the Cutter

The design of both the cutter and its arbor, as already described, should afford a sufficiently secure frictional drive for all ordinary purposes if the arbor clamp-nut is firmly tightened while the arbor is gripped in the vice.

If, however, it is considered that a positive form of drive is necessary, then a key is fitted to the arbor to drive the cutter.

Although a No. 31 drill was specified as being the next smallest drill below $\frac{1}{8}$ in. in common use, this and other reaming operations will be facilitated if a drill more nearly to the size of the finished hole is employed.

A No. 31 drill has a diameter of 5 thousandths of an inch below $\frac{1}{8}$ in., but drills of the Dormer brand are readily obtainable in diameters of 3.1 mm. and 3.15 mm. which are less than $\frac{1}{8}$ in. by 3 and 1 thousandths respectively.

The key shown in the drawing is fitted flush at one end of the cross-hole, and at the other, the rounded end projects for a distance of 3/32 in. The keyway in the cutter, illustrated in Fig. 42C, is formed to shape with a small round file

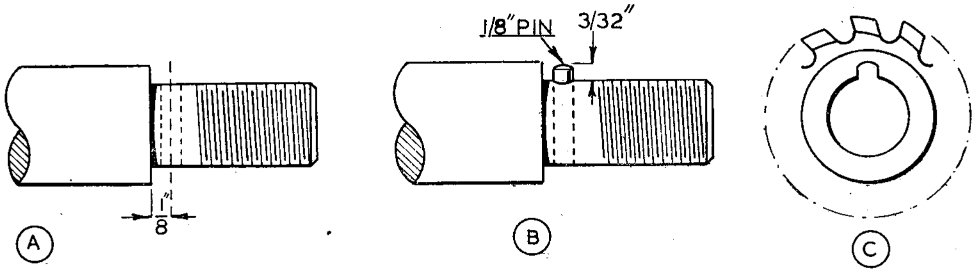


Fig. 42

In the present case, as shown in Fig. 42A, the arbor is cross-drilled with a No. 31 drill and the hole so formed is enlarged with the tip of a $\frac{1}{8}$-in. reamer, until a short length of $\frac{1}{8}$ in. diameter silver-steel can be lightly pressed into place in the vice to form the key illustrated in Fig. 42B. Do not use undue force when pressing in the key, as this may result in bending the arbor and distorting the cutter seat.

so that its sides are parallel and it fits the key closely; the bottom of the keyway is rounded and should be filed to clear the end of the key.

Furthermore, it should be noted that the keyway is cut directly opposite a tooth, and although in the present instance the location is not of great importance, this procedure should always be followed when cutting keyways; for a small cutter or other similar component may be considerably reduced in strength if the keyway is formed where there is insufficient surplus material.

*Continued from page 191, "M.E.," August 11, 1949.

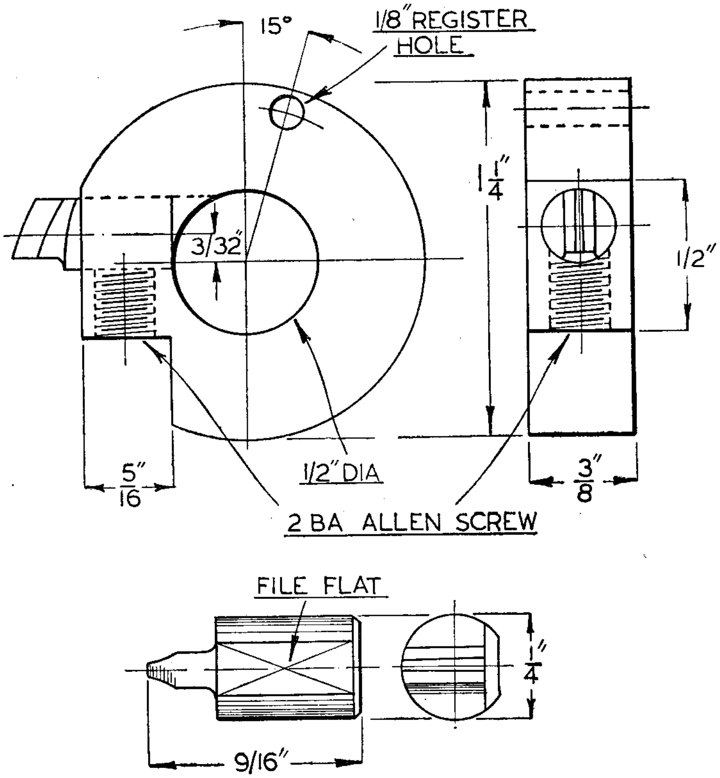


Fig. 44. Fly-cutter and circular carrier

Making Fly-cutters

As previously mentioned, fly-cutters may be used for gear cutting, particularly where small teeth are cut in materials such as brass and aluminium ; moreover, a simple cutter of this type will often be found fully effective for machining steel and cast-iron gears when only a small number of teeth has to be cut.

The advantages gained are that only one cutter tooth need be machined to shape ; also, any of the cutters so made can be mounted in a single holder to form a complete gear cutter.

In addition, the hardening, tempering and sharpening processes are more readily carried out, and there is less danger of the cutter being damaged by cracking or distortion during the quenching operation.

If, as shown in Fig. 43, the body of the cutter is made like that of a circular gear-cutter, then it will be possible both to relieve and sharpen the cutter-bit by using the appliances already made for this purpose.

Reference to the working drawings in Fig. 44 will show the dimensions of both the cutter body and the inset cutter, whilst the successive steps in machining the body are represented in the operational drawings in Fig. 45.

The cutter body is turned from a length of mild-steel, and is bored and reamed to fit the eccentric and other arbors as well as the jigs already made.

After the $1\frac{1}{4}$-in. disc has been parted off to a length of $\frac{3}{8}$ in., it is mounted in the drilling jig for forming the hole to engage the register pin fitted to the eccentric arbor.

The disc, together with a circular gear-cutter, is next mounted in the sawing jig, so that the position of the cutter tooth lying at 105 deg. from the register hole can be marked on the face of the disc. This procedure is to ensure that the fly-cutter is correctly located in relation to the eccentric mechanism used for relieving the cutting edges.

As shown in Fig. 45 (3), a line is scribed from

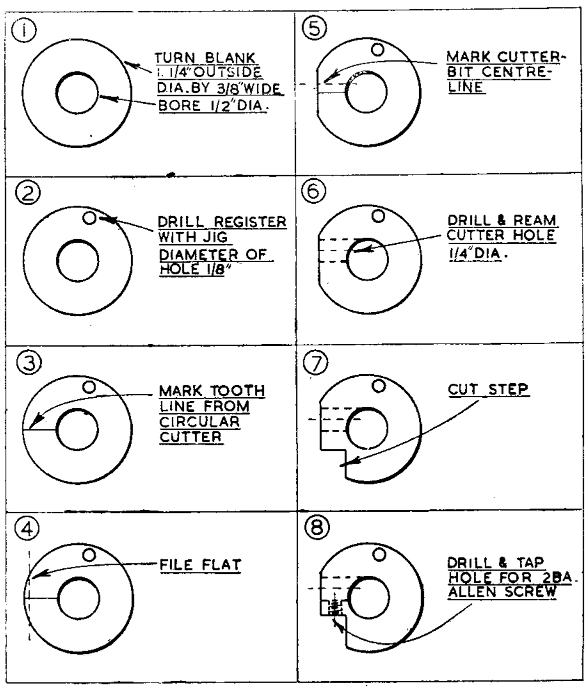


Fig. 45. Machining the fly-cutter carrier

the outer end of this tooth line towards the centre of the bore, in order to denote the position of the inset cutter-bit; the centre-line of the cutter is then marked-out by scribing a line 3/32 in. above the previous line.

Next, a flat, ½ in. in length, is filed at right-angles to the cutter centre-line, and when the latter line has been continued across the filed flat, a hole is drilled at its centre and then reamed ¼ in. through to the bore to receive the fly-cutter.

Following this, the step shown in the drawings is cut out to allow the 2 B.A. Allen clamping-screw to be fitted. This completes the body of the cutter, and it now remains to make the fly-cutter itself.

The fly-cutters are made from ¼ in. diameter round silver-steel in accordance with the drawing

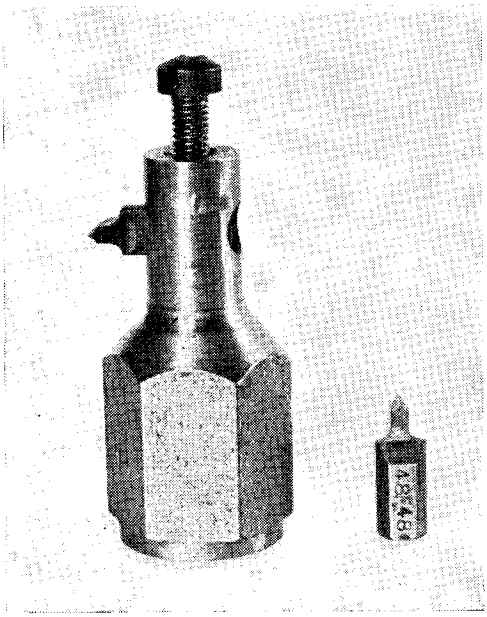


Fig. 46. Alternative mounting for fly-cutter

in Fig. 44, and it will be seen that a flat is formed on the lower surface to afford a seating for the clamp-screw which thus locates the cutter correctly. When the short length of steel has been securely clamped in the cutter body, it is machined and the tooth is relieved in exactly the same manner as described for making a circular gear-cutter.

After the finished fly-cutter has been hardened and tempered, it is again secured in its carrier, and the latter is mounted on an arbor to enable the honing jig to be used for sharpening the cutting edges. It will, however, be found that the gap in the table of the honing jig must be enlarged to accommodate the fly-cutter.

In order that gear teeth may be machined as rapidly as possible, the fly-cutter should be run at the maximum cutting speed; this in the case of a silver-steel cutter will be some 50 ft. per minute for steel; and it follows that if the radius of the fly-cutter is halved, the number of its revolutions per minute can be doubled for the same cutting speed. This in effect means that the shorter cutter has the equivalent of two cutting teeth for the single tooth of the longer cutter mounted in the manner already described. When the fly-cutter is mounted as represented in Fig. 46, its turning radius is reduced to ⅜ in. as opposed to ¾ in. when the large circular carrier is used.

The arbor seen in Fig. 46 is made to screw on the mandrel nose of the lathe or milling machine, but it can equally well be held in the lathe chuck. This fly-cutter and arbor were used for cutting the gear wheels depicted in Fig. 48.

This form of mounting is quite effective for light gear cutting, provided the lathe has a rigid mandrel and support from the tailstock centre is not necessary. A special arbor, however, must be made for carrying the cutter when relieving its cutting edges. For this purpose, a mandrel, similar to that shown in Fig. 46, is made, but instead of drilling the cross-hole on the centre-line as shown, this hole is drilled some 3/64 in. above centre for cutters of ⅜ in. radius; this has the effect of mounting the cutter eccentrically, so that after the tooth has been machined in this position, it will have the requisite clearance or relief when the cutter is mounted in its working position on the centre-line of the mandrel.

The marking-out and drilling will be facilitated if a flat is formed on the side of the arbor, as was done in the case of the large cutter carrier.

When the cutter-bit is located above centre in this way, its cutting edges can be relieved by an ordinary continuous turning operation using the two-pin forming tool, and the intermittent motion imparted by the eccentric rocking gear is not required.

Fly-cutters made in this way can equally well be used in a cutter-frame of the type previously described.

Lubricating the Gear-cutter

When machining the profiles of the cutter teeth with the relieving tools, the finish imparted to the tooth flanks and cutting edges will be greatly improved, and the accurate machining of gear teeth in general will be facilitated, if a small but constant supply of suitable cutting oil is fed to the work. Amongst other lubricants and cutting fluids, Houghtolard or Cutmax will be found to give excellent results; moreover, an important consideration in the small workshop is that these fluids do not cause rusting of the tools or lathe slides.

Commercially, a steady stream of cutting fluid is fed under pressure to the work-face by means of a suds pump. This procedure, however, is not as a rule applicable in the small workshop, nor is it really necessary, for the large volume of cutting fluid is employed mainly to dispel the heat arising during the rapid machining normally undertaken, and only a relatively small supply of oil is necessary to lubricate the tool effectively at a slower rate of working.

Applying the oil with a brush may be a tedious proceeding, and moreover, the bristles will be cut off by the cutter teeth; the alternative of

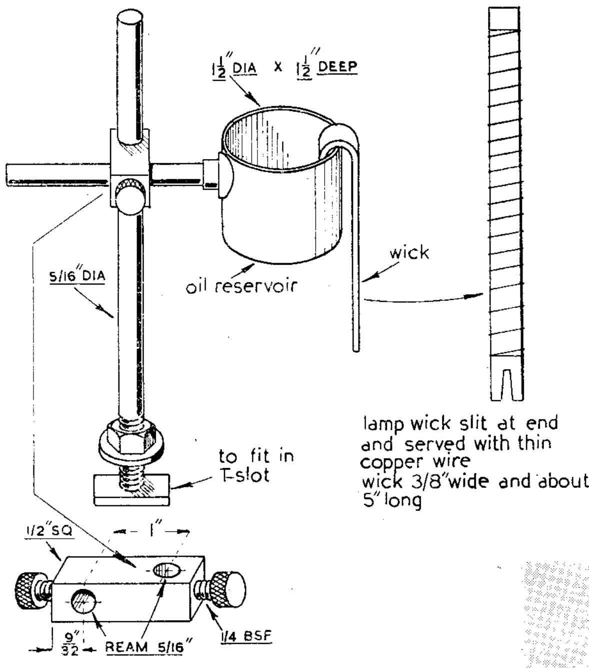


Fig. 47. A wick oiler for lubricating the gear cutter

using a continuous drip will not only waste oil, but will also entail unnecessary work in cleaning the lathe.

The form of oil feed illustrated in Fig. 47 can be readily set in any position when attached to the lathe saddle, and the wick will supply a constant supply of cutting oil from the container to any part of the work ; in addition, the supply of oil can be automatically maintained when turning a long shaft as the appliance travels with the saddle.

The pillar is secured to one of the cross-slide T-slots by means of its foot-piece and clamping-nut. The construction of the container enables it to be set at both the correct height and overhang and then locked in position by means of the clamp-screws fitted to the sliding bracket. The oil is fed to the work through a length of lamp wick or a strip of felt, which is served with thin copper wire to stiffen it and keep it in contact with the work. After being wound on, the wire coils are pinched flat with the fingers to preserve the original form of the wick, as shown in Fig. 47. The prepared wick is then bent into the shape of an inverted V so that it will hang from the lip of the container with one end submerged in the oil.

The rate of feed will be quickened owing to greater syphonage action if the dependent limb of the wick is increased in length.

It will be noted that the wick is slit at its lower end to enable it to make contact with both flanks of the cutter teeth, and at the same time to keep properly in place. Should the rocking motion of the cutter cause the wick to jump upwards, a wire clip may be used to retain it in place.

Those who fancy a more elaborate form of adjustment can attach the container to its pillar by means of link arms fitted with spring loaded ball joints ; this will afford a universal form of movement for quickly setting the position of the oil feed.

Gear-cutting Operations

When either the circular cutters or the fly-cutters made in the workshop with the aid of two-pin form tools are used for gear cutting, the method of machining the gear teeth on the wheel blank differs in one particular from that described in connection with commercial gear cutters ; that is to say, an allowance, termed backlash and listed in Tables A and B already given, has to be added to the tooth depth cut in order to produce the correct tooth form.

The theoretical depth to which the gear teeth are cut, when using commercial gear cutters, was given previously in a table showing this dimension for gears of from 10 to 40 diametral pitch ; but this can be readily calculated, for it is equal to the Constant 2.157 divided by the diametral pitch, so that the tooth depth of 10 D.P. gears is 0.2157.

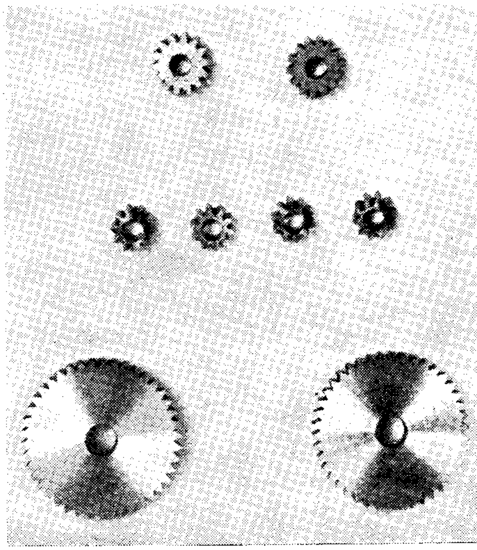


Fig. 48

It will be remembered that, as an example on a previous occasion, a description was given of making a form tool and gear cutter suitable for cutting a gear wheel having 30 teeth of 40 d.p. and 20 deg. pressure angle.

When this gear wheel is machined with the cutter described, the theoretical depth to which the teeth are cut is 2.157 divided by 40, or

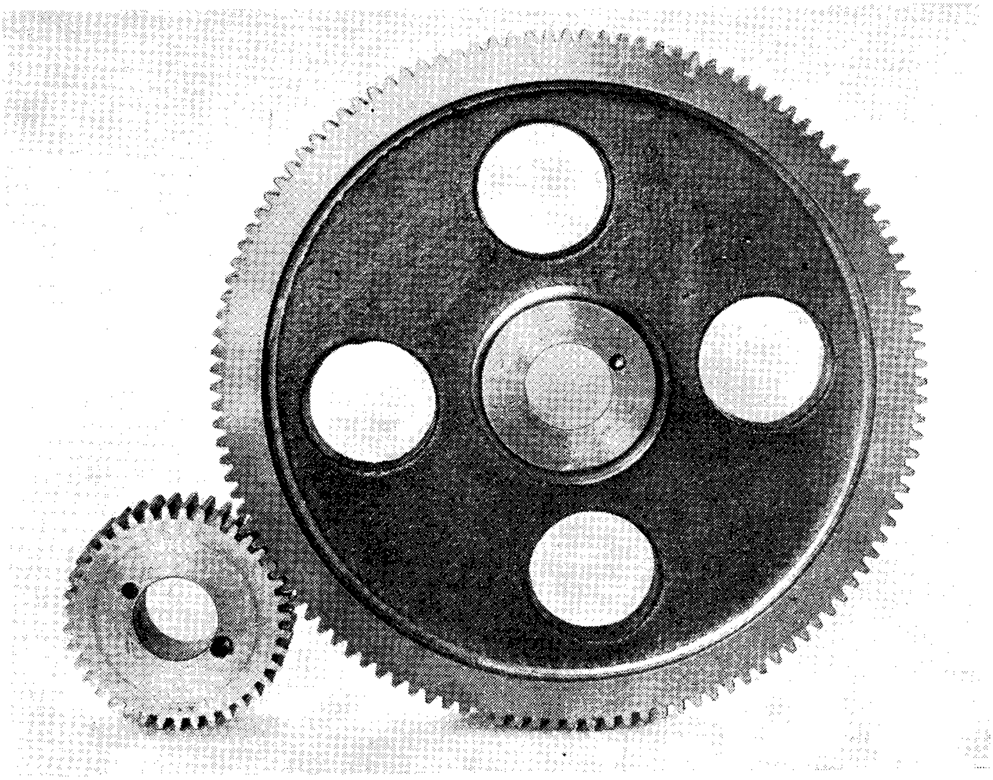


Fig. 49

0.0539, but to this the backlash allowance must be added. According to Table A, the backlash for a 40-tooth wheel of 1 D.P. is 0.070 ; therefore, it is 1/40 of this amount for 40 D.P., that is to say 0.00175, which added to the previous figure 0.0539 gives a total tooth depth of 0.05565.

In actual practice, the machine slide controlling the depth to which the teeth are cut would have its micrometer index set to $55\frac{1}{2}$ thousandths of an inch.

Cutting Racks

A rack may be regarded as part of a gear wheel whose diameter is so large that the pitch circle has become a straight line, and in consequence the flanks of the teeth are almost, if not quite, straight-sided.

This results in the rack cutter form tool (A) in Table A having cutting pins of very large diameter, but in practice these pins are not made whole circles but segments only of circles which are attached to the tool shank at the specified centre distance apart.

With these cutters, racks of short length can be cut when the work is secured to the lathe saddle and the leadscrew feed is used to space the teeth. This will entail cutting the teeth to their full depth at a single passage of the work across the cutter, for no height adjustment is then available.

If, however, the vertical slide is brought into use, it can be employed to feed the work upwards against the cutter while the cross slide serves to regulate the tooth depth.

To obtain the correct spacing of the rack teeth, the diametral pitch is converted to circular pitch, which represents the centre distance between adjacent teeth measured on the pitch circle, but as this circle, as already noted, has become a straight line, a direct linear measurement can be made.

The circular pitch is obtained by dividing 3.1416 by the diametral pitch, and the more commonly used conversions are listed in the following table.

Diametral pitch	Circular pitch	Diametral pitch	Circular pitch
16	0.1963	30	0.1047
18	0.1745	32	0.0982
20	0.1571	34	0.0924
22	0.1428	36	0.0873
24	0.1309	38	0.0827
26	0.1208	40	0.0785
28	0.1122	42	0.0748

When the linear pitch of the rack has been obtained in this way, a reference card should be made out showing the position of each tooth space in relation to the reading of the leadscrew index.

If this precaution is taken, it should enable errors to be avoided during the cutting of the whole series of rack teeth.

The large wheels are made of bronze and have 42 teeth, whilst the small pinions having 10 and 14 teeth are machined from steel to premit their being hardened to reduce wear.

The two gear wheels shown in Fig. 49 were made for use as lathe change wheels; both are of 24 D.P. and were machined with circular gear-cutters made in the workshop by the method

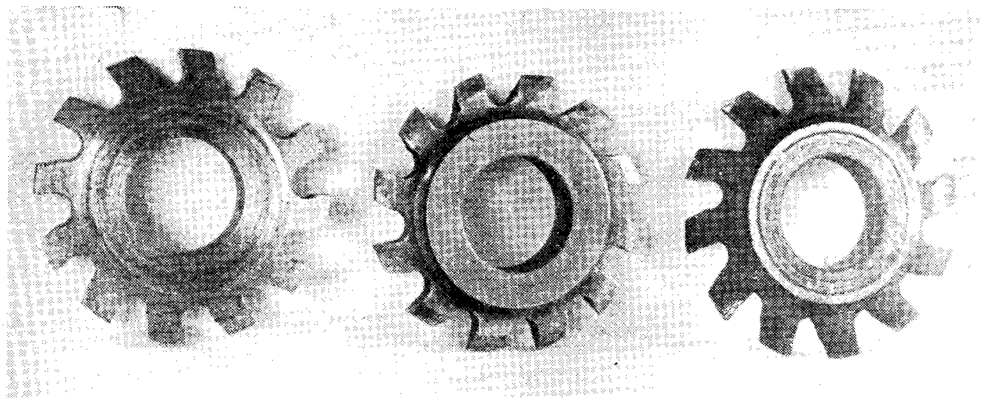


Fig. 50

Examples of Work

Most of the examples here illustrated were put at our disposal by Mr. J. Rodway, A.M.I.Mech.E, who it will be remembered very kindly gave us a full account of his method of making gear cutters.

The set of gear wheels and pinions illustrated in Fig. 48 were made for the drive of an electric locomotive. All the wheels are of 48 diametral pitch and were cut with fly-cutters of the type depicted in Fig. 46. To avoid having to undercut the teeth of the small pinions, in order to prevent interference when running, a pressure angle of 30 deg. was adopted.

already described. The large wheel has 120 teeth and the smaller 39 teeth. The tooth contact faces are machined to a high finish, and as the teeth appear to mate very accurately, quiet and even running should be assured.

Lastly, Fig. 50 depicts three gear cutters; that on the right is for cutting wheels having from 35 to 54 teeth of 34 D.P., whilst the cutter in the centre and the unfinished cutter on the left were made in our own workshop, together with all the necessary jigs, cutter relieving gear, and arbors which have appeared in the published photographs and drawings.

"L.B.S.C."

(*Continued from page* 248)

the faceplate on the lathe nose, run up the rest with the stay on it, then apply your try-square to the job, the stock resting on the faceplate. Set the edge of the stay to the blade, tighten the clamp, and you're all set. Replace chuck, put the end-mill in it, start the lathe, and traverse the stay across the cutter by means of the cross-slide handle, feeding into cut with the top-slide handle. Do the other end same way: and if you haven't a slide-gauge with which to measure the correct overall width, just cut a gap $2\frac{15}{16}$ in. wide in a bit of sheet metal (bit of tin would do) and use that for a gauge. Both ends could, of course, be carefully hand-filed, and the try-square used to make certain the sides were at right-angles to the top and bottom.

To make the stay from $\frac{1}{8}$-in. sheet or plate, saw out a piece $3\frac{11}{16}$ in. long and $1\frac{1}{8}$ in. wide. Scribe a line across this, $\frac{1}{2}$ in. from each end; then put it in the bench vice with one of the lines just showing at the jaws, and hammer the projecting $\frac{1}{2}$ in. over to a right-angle. The $\frac{1}{8}$-in. thickness of metal forming the angles, will bring the overall width to $2\frac{15}{16}$ in., which is correct. File away $\frac{1}{8}$ in. at top and bottom, as shown in drawing.

In either cast or plate stay, find the centre; make a pop-mark, drill it first $\frac{1}{8}$ in., then open out with a 15/32-in. drill, and tap the hole $\frac{1}{2}$ in. by 32 for the pump. Then place the stay between the frames, at the point where the three holes are drilled each side, the flanges overlapping the holes so that the screws will be central. The bottom of the stay should be level with bottom of frames, and the stay itself exactly vertical; test with the try-square. Then put the big cramp across the frames, to hold them tightly against the stay; run the No. 40 drill into the three holes each side, making countersinks on the stay. Follow up with No. 48 drill, tap 3/32 in. or 7 B.A., and put in countersunk screws to suit. That completes the frame erection, and the next job will be the axleboxes and springs, and the hornstays.

How to Make Lathe Carriers

A Job for the Beginner

by J. K. M.

SOME time ago, while doing a job between centres on the lathe, the tail of the carrier broke off, and since it was the only one I possessed and it being a public holiday and all shops closed, it looked at first as though all work would come to a standstill. It was at first decided to make a substitute from a large nut with a bit of rod screwed in at one side, but on second thoughts I recalled that this sort of thing can be carried too far and that what is at first "just temporary" can, through indolence or habit, become just another piece of improvised equipment, often very ugly to look at; nearly always inconvenient to use. This, in fact, had been the case with the carrier now lying in two pieces on the bench; it was made of brass, its screw was not long enough to suit small jobs, its bore had been filed out to take jobs which were just a fraction too large, and its screw was badly "burred" so large jobs would not go in, because the screw could not be properly withdrawn.

In short, improvisation was not, in this case, looked upon as a virtue and it was decided to make a set of three carriers which would handle

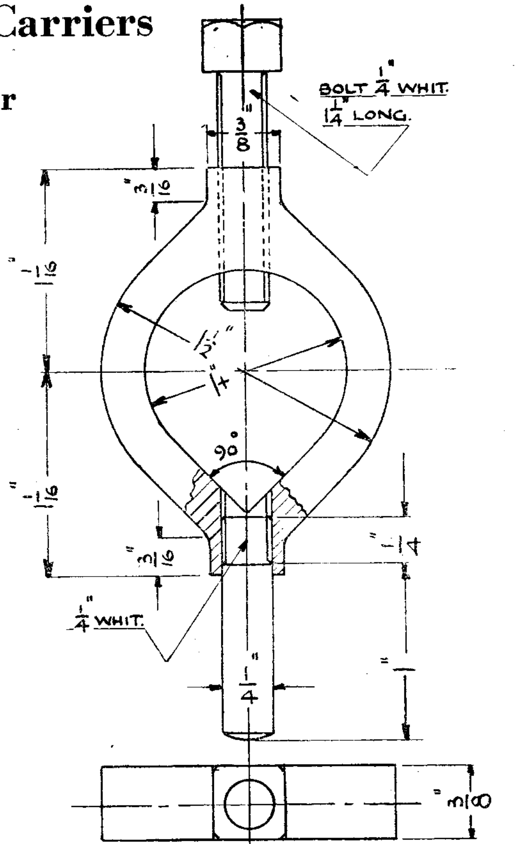


Fig. 2. Lathe carrier, 1 in. capacity

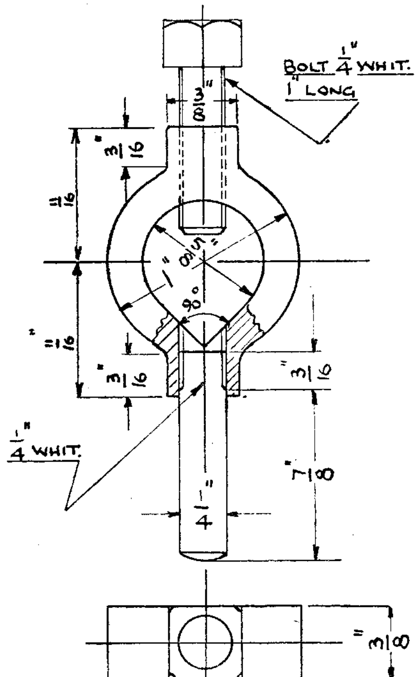


Fig. 1. Lathe carrier, 5/8 in. capacity

all work from ¼ in. to 1¾ in. diameter, having regard, of course, to the material available at the time. A few sketches were got out and the carriers were made as their need arose. They have been so satisfactory in use and are so easy to make, that I venture to offer drawings and a few notes on their construction to beginners who are interested in making their own tools.

Figs. 1, 2, and 3, show three sizes having capacities of ⅝ in., 1 in. and 1¾ in. respectively. They are made throughout of steel and will suit most lathes of 3 in. to 4 in. centres. In addition the two smaller carriers are suitable for use on lathes of about 2½ in. centres and this size lathe is also suitable for making them.

The carriers shown in Figs. 1 and 2 are made up of three parts, the body, the bolt and the tail. In each case a piece of steel bar, ⅜ in. thick will be required for the body and ¼ in. round rod is used for the tails. The bolts are standard. The larger carrier shown in Fig. 3 differs from the others in having a short tail, solid with the body, and steel bar ½ in. thick is used in this case.

To make the smaller size carrier (Fig. 1) first get a piece of steel bar 1 in. wide by ⅜ in. thick (it need not be bright drawn, black will do) and

after sawing to length, file both ends square with the sides until it is $1\frac{3}{8}$ in. long. Now mark out the lines as shown in Fig. 4. You don't need a surface plate and surface gauge for this; it can all be done with a small try-square, rule and scriber. Mark the centre lines first, putting a very light centre punch dot on the point where they cross. Now set the dividers to $\frac{5}{16}$ in. and scribe the inner circle. Reset the dividers to $\frac{1}{2}$ in. and scribe the outer circle. If you are using black steel bar you will find that the corners are slightly rounded, so when the divider leg gets to the edge it will be in "mid air." Thus the outer circle will have a bit missing here and will not look at all like Fig. 4. Don't worry about this, sketches are only symbols, intended as a general guide, they don't always fully represent what actually happens when you do the job yourself. Of course, if the divider leg overhangs the edge of the metal much more at one side than the

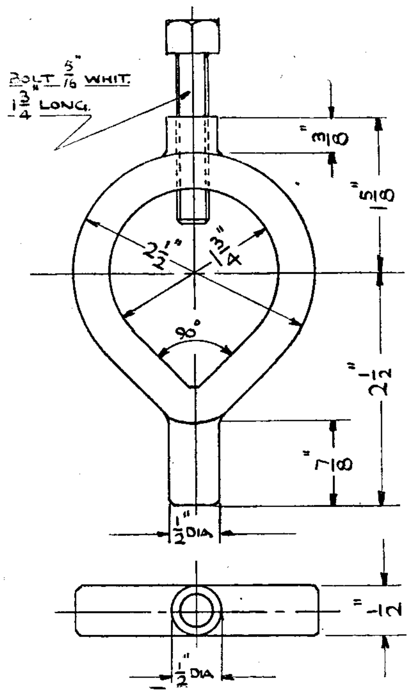


Fig. 3. *Lathe carrier,* $1\frac{3}{4}$ *in. capacity*

other, the position of the centre dot is wrong and should be corrected. To help in setting the work up later, the inner circle can be dot punched at the four points where it crosses the centre lines. Now mark the horizontal lines above and below the longer centre line as shown in Fig. 4. This is best done by setting the dividers to $\frac{3}{16}$ in. and making the little arcs and then drawing lines with the scriber and try-square to just touch them. You now have the shape of the job marked out. The lines shown in Fig. 4 at the ends of the metal must now be marked in. These give the positions for drilling and tapping the holes to take the bolt and the tail and a deep centre dot should be placed where the centre-lines cross.

The outline should now be lightly centre punched as a guide for sawing and filing to shape later on. If you wish, the marking out can be done on both sides, but if you can use a file and saw with moderate skill there is no need for this.

If you only have a small lathe, the next step is to set the job up on the faceplate to bore out the $\frac{5}{8}$ in. diameter hole. Have a piece of wood between the plate and the job to allow the boring tool to do its work without damaging the face-

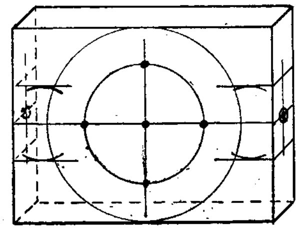


Fig. 4. *How to mark out the body*

plate. Two simple clamps will be enough and when the $\frac{5}{8}$-in. circle is running truly, tighten the clamp bolts, check again and drill through from the tailstock, opening out the hole in stages until a boring tool can be got in to finish to $\frac{5}{8}$ in. diameter. Owners of larger lathes can, of course, mount the job much more rapidly in the four-jaw chuck to do this.

The next operation is to drill and tap the ends $\frac{1}{4}$ in. Whitworth. This can also be done on the lathe if a drilling machine is not available, by supporting the work with the tailstock centre and feeding the work into a drill held in the lathe chuck. Mind your fingers as the drill breaks through into the bored hole. Many engineering handbooks give the tapping size for $\frac{1}{4}$ in. Whitworth, as $\frac{3}{16}$ in., but when tapping steel it is advisable to increase this to 13/64 in. and thus reduce the risk of breaking the tap in the hole. Note that at one end the tapping hole is opened out to a full $\frac{1}{4}$ in. for about $\frac{1}{16}$ in. deep to let the tail screw home securely. By doing this, there will be less likelihood of the tail becoming loose in service.

The body is next finished to shape by cutting away the waste metal with a saw and finishing with a file. First file out the "V" in the $\frac{5}{8}$-in. hole. This is best done "by eye," holding the job vertically in the vice and using a square file. Stop filing when the sides of the "V" form tangents to the hole. The sawing need not be hard work if a new blade is used, and one 12 in. long and having about 18 teeth per inch will make light of the work.

The tail is simply a bit of $\frac{1}{4}$ in. diameter steel rod, threaded $\frac{1}{4}$ in. Whitworth at one end and is screwed tightly into the body. The exposed end should be neatly rounded off as shown in the drawings. As already stated the bolt is standard, but it must be well chamfered off at the end. If this is not done, the metal will, in time, spread like the head of a much used cold chisel, rendering its removal very difficult. The end of the bolt may, of course, be casehardened.

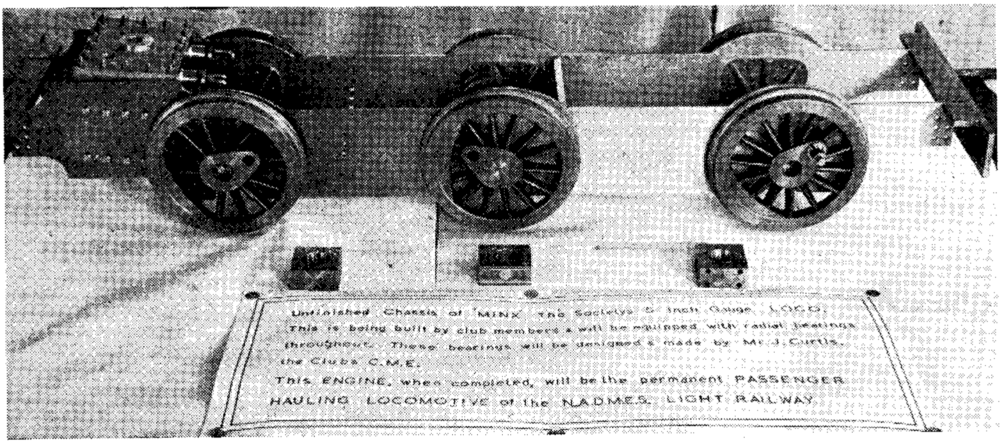
So much for the smaller carrier. The next

(*Continued on next page*)

Newton Abbot's Second Exhibition

THE second annual exhibition of the Newton Abbot and District Model Engineering Society held in the Congregational Hall, Newton Abbot came to a close at 9 p.m., Saturday, July 9th, after a very successful seven-day run, despite heavy competition from the sun.

The show was officially opened by the Chairman of the local Council, Mr. A. H. W. Edworthy and some 3,000 people passed through the doors and saw models from all the model engineering clubs in Devon, Cornwall and Taunton, during the days of opening. It was a truly magnificent display of work of a very high standard.



The model engineers' workshop, in which work was in progress on parts for "Minx," the club locomotive, proved very popular (see photo above); but there is no doubt that the biggest attraction was the passenger-hauling on the 75-ft. of track layed down the length of the Hall. Unfortunately, the only completed locomotive in the club, owned by Mr S. G. Underwood, broke down, but in the true spirit of inter-club mutual help Mr. W. Lock, of South Molton and Mr. W. J. Manley, of Exeter Model Engineering Society, came to our rescue with their locomotives, a gesture for which we are greatly indebted.

There were approximately 150 models on show in various stages of completion, covering all branches of model engineering.

A fine trade stand of lathes and small tools was staged by Messrs. Edward & Drage, of Exeter.

On Saturday, the 9th, visiting clubs from Perranporth, Plymouth and Exeter were entertained to tea, and thanks are due to those and other Societies in Devon and Cornwall for the assistance they rendered in making the exhibition the success it undoubtedly was.

It might be of interest to recall that Newton Abbot and District Model Engineering Society held its inaugral meeting on April 4th, 1948. Since that time 36 enthusiasts have joined the club; two very successful exhibitions have been staged; it produces a first-class quarterly journal "The Blower" which includes eight pages of printed advertisements and covers and no less than 32 pages of articles, workshop hints, drawings and cartoons, etc. Also, having the permission and support of the local Council a 400-ft., continuous multi-gauge track in concrete and steel is being built and erected in the Penn Inn Park; 75 ft. have already been completed. Materials to finish the project have been purchased.

Information regarding the activities of the Society may be obtained from D. Knell, 9B, Pinewood Road, Milber, Newton Abbot.

How to Make Lathe Carriers

(Continued from previous page)

one (Fig. 2) is made in exactly the same way, but to make the larger one shown in Fig. 3, the procedure is slightly different. Here the tail is solid with the body to cater for the heavier loads it may have to carry when working on large diameter shafts. Mark out exactly as before but this time the ends of the blank must be centre drilled. After boring out to $1\frac{3}{4}$ in. diameter, the waste metal around the tail (and also around the boss for the bolt) is cut away with the hacksaw and the job set up between centres. Each end is then turned down to $\frac{1}{2}$ in. diameter, the tail being made $\frac{7}{8}$ in. long and the boss $\frac{3}{8}$ in. long. The bolt hole is then drilled and tapped $\frac{5}{16}$ in. Whitworth and the job finished to shape as before.

*TWIN SISTERS

by J. I. Austen-Walton

Two 5-in. gauge locomotives, exactly alike externally, but very different internally

SET up the blocks, one by one, holding them in the four-jaw chuck with the outside or flanged face inwards. Before tightening any of the jaws, insert little pieces of brass packing, about $\frac{1}{16}$ in. thick, between all four jaws, and adjust up until the block runs fairly true. Now run indoors and get a nice bright sewing needle, and, if possible, a pea of putty or plasticene.

Stick the eye of the needle into the putty, and stick the putty on to any projecting screw or corner of the toolpost, or even on the point of the tool still held in it, arranged so that the needle points towards the lathe chuck. Bring up the slide or saddle until the needle point almost touches the face of the work and, if your eyes are good you will be able to adjust the work in the chuck so that the needle point just sweeps past the sides of the block when the chuck is revolved slowly by hand. Do two opposite sides at a time, finally checking all four sides after latest adjustment. This is a very old toolmakers dodge, and so reliable and simple that I can bore a block centrally to within half a thousandth, repeating the performance as often as necessary, and all without a measuring-tool or scribing-block in sight.

Now centre and drill through, leaving plenty for taking out with a boring-tool. The bores and counterbores are straight machining jobs with which you should all be able to cope.

I think the other gunmetal part that is turned to fit into the large bore of the axlebox, should be made available in casting form, although I happened to have some big bar material that came in rather well for the job, and was not too wasteful; but in either case, the machining is again very clear and simple, and it is almost unnecessary to point out that the one part should really fit the other as closely as possible, or oil will leak away too easily. The advantage of using the casting lies in its ability to be cast already square, leaving enough for filing or milling off the edges to match the sides of the axlebox.

So far, nothing has been said about the round crown shown on the drawing, which does much to enhance the look of the box. It is quite easy to turn this top to shape, but to do so calls for the making of a very simple fixture. This is nothing more or less than a spigot on a plate, the spigot being turned to fit the $\frac{5}{8}$-in. bore of the axlebox, whilst the plate carrying the spigot is

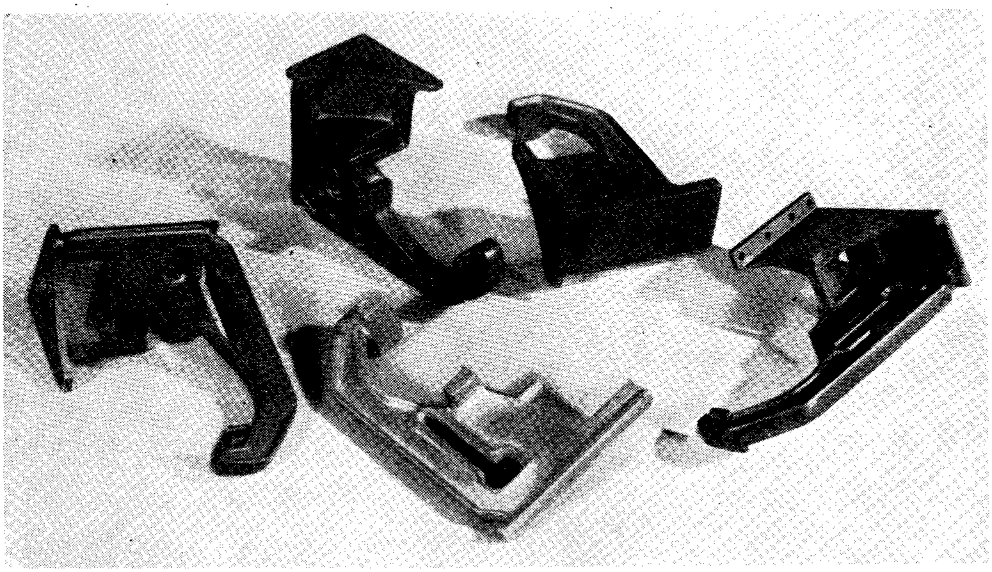


Photo by] [*A. Duncan*

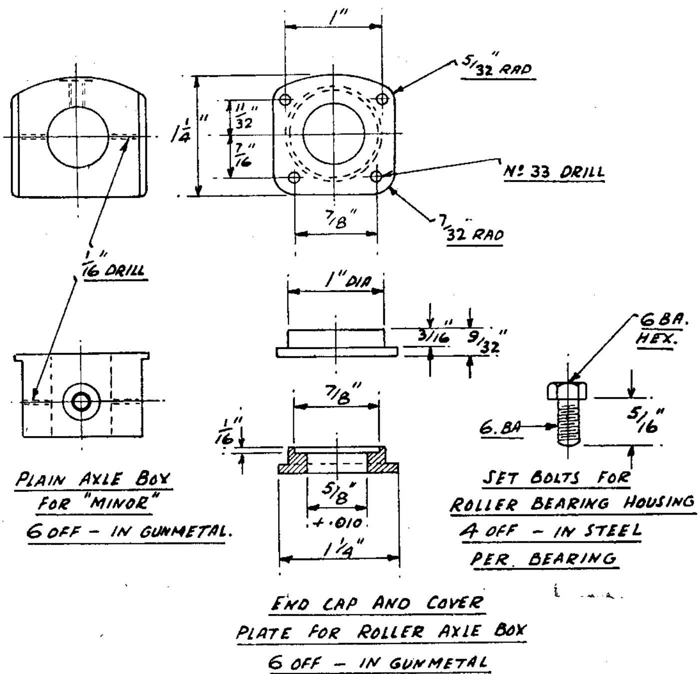
Motion plates and metal pattern—the shape of things to come!

*Continued from page 30, "M.E.," July 7, 1949.

bolted to the faceplate so as to give the entire box the necessary swing for turning. It is, of course, necessary to put a thread on a turned-down portion of the spigot, which projects enough for the fitting of a nut and a large-diameter washer, to hold the whole lot solid, and the rest of the setting up consists of wangling the plate about on the faceplate until a needle and a bit of putty mounted as before, follows the arc you scribe as a guide on the first axlebox to be tackled. The other five boxes take very little time to complete, once the spigot plate position is fixed.

Before doing this job, however, I suggest you fit the box cover plate or bush with the four set-bolts as shown on the drawing, which will enable you to turn the same crown line on both parts together, and before separating them, a little judicious handling in the four-jaw chuck once more, should enable you to pick up and turn off the other three sides of the cover back to the same level on the bottom and sides of the cover, back to the same level on the bottom and sides. Do not forget to apply the same marking or numbering process to the two parts before separating them.

The remaining holes may now be drilled, tapped, and spot-faced, as directed, and special care must be taken to ensure the entire removal of all burr, where the two holes break through into the main tunnel of the box; if this is not done, you will have trouble in getting the outer roller race to fit in properly, and the very devil to pay should you want to get it out for any reason. You will notice that the two trailing axleboxes, although similar to the others, have a different arrangement of tapped holes in their bottom faces.



PLAIN AXLE BOX FOR "MINOR" 6 OFF – IN GUNMETAL.

SET BOLTS FOR ROLLER BEARING HOUSING 4 OFF – IN STEEL PER BEARING

END CAP AND COVER PLATE FOR ROLLER AXLE BOX 6 OFF – IN GUNMETAL

Now we come to the steel work, and mild-steel at that, and no option either. These parts will all be case-hardened and you will find "Ledloy"—pretty well known by now, I think—one of the very best materials for an even and flawless "case." To go with this as a highly successful partner, a tin of "Antol" cyanide hardening powder will complete the team. (No, Mr. Editor, I really am not doing a bit of advertising on the side.)

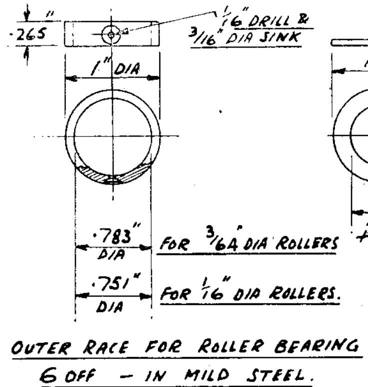
Turn up the outer races, making the bores smooth and bright, and not relying too much on emery to achieve it, as this has a tendency to produce a slightly convex surface, no matter how skilled you may be. Above all, get the bores to the exact right size, even if you have to make a simple plug-gauge to ensure it. Next in importance is concentricity, best secured by turning inner and outer parts at one setting, and afterwards parting off from the main bar.

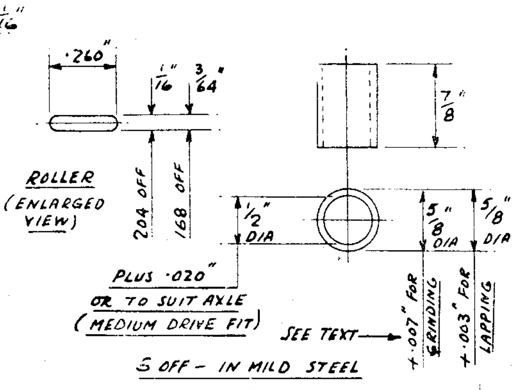
Put these parts on one side and by drilling, boring, and parting off, make the steel washers, afterwards rubbing them down on emery paper to get a good smooth surface; a parting tool, as a rule, never leaves the best of finish. Washers cut out of $\frac{1}{16}$-in. steel plate are also unsuitable, due to lack of flatness, and a leaning towards curling slightly during the case-hardening process. That's another set of parts to put on one side. The rollers are the most tiring part of the job, in view of the number required. The actual making of these in selected silver-steel is a matter of spending a number of hours parting off tiny bits of steel, and using a very narrow parting tool. It is as well to reduce the burrs both back and front, with a small smooth file before the tool separates the work, and to rig up some sort of tray to catch the little devils as they come off. Some are bound to get lost, and for your guidance the number required for the six bearings is two hundred and four or, more pleasantly expressed about two and half hours work. The hardening will be done in bulk, which is much less tedious.

Since I mentioned the roller-race in the first instance, I have ascertained that suitable rollers are to be obtained all ready made, hardened, ground, and super-finished. These are part of some surplus war stock and are very cheap to buy. I have to hand a few specimens, just the right length but 0.078 in. diameter instead of 0.062 in., and in every way suitable for the job. With these it would call for twenty-eight rollers per bearing, total one hundred and sixty-eight, instead of the thirty-four rollers in the smaller size, and the total as first mentioned.

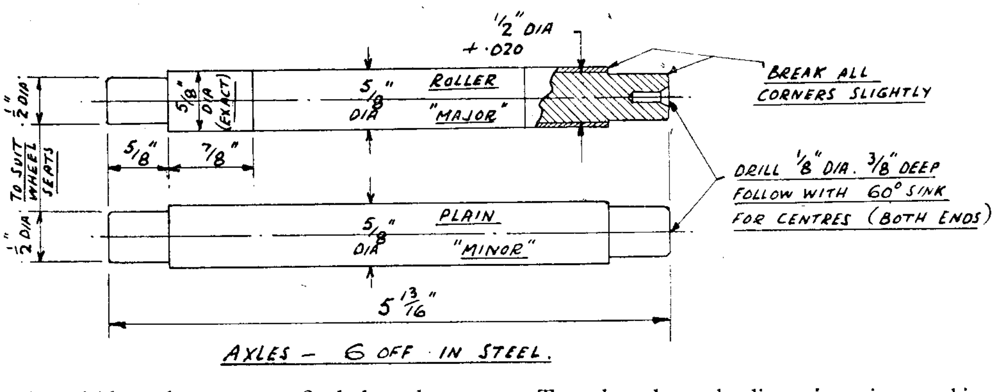
To make quite sure of the position, especially in these days of uncertain supplies, and in case of disappointments, here is the rest of the story to finish the rollers that are home-made.

Make up a small sheet steel box, by knocking and folding up four sides without any join, and large enough to take the total bunch of rollers; I would say that one and half inches square





would be quite suitable, and provide some means of picking up the box when hot, either with a crude handle riveted on, or a bent lip to the box for lifting with pliers or tongs. Heat the box and contents to a bright cherry-red, and decant the contents into a pan of hot (not boiling) water. Take the rollers out and dry them on a piece of rag, by folding them up in it, and rubbing them about, and transfer them to another piece of clean rag, soaked with metal polish. You can now rub them about all ways until the fine black



scale and bloom has gone; a final clean dry rag episode and a tin of thin oil for a home, and the job is done. There is no need to temper these parts as they are never subjected to anything more than pure crushing—a condition they will enjoy in the dead-hard state with ease.

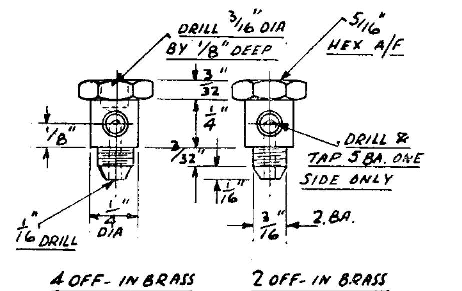
Perhaps the most exacting part of the job is the finishing operation to the inner race member of the bearing, and this forms an integral part of the axle, and must never be removed. Reference to the drawing shows for preference, a stainless steel axle the specification of which might be either Firth's E.M.S. or Kayser Ellison's No. 40, commonly called for as K.E.40. Both these materials are a perfect joy to turn, but as the amount of turning to be done is so simple and so straightforward, almost any grade of steel could be employed. The builders who are against stainless steel at any price, may find consolation in using old car-axle steel (some is good, some bad—it is just a gamble) and always in preference to bright rolled mild-steel, and certainly in preference to silver-steel which has by far too short a grain for shock torsion. I believe it has become popular because of its great stiffness and, reasonably loaded, has points in its favour. In its unhardened state, it is open to criticism, on points of suitability for surface wear, and I know of few men in the trade who would use it for that purpose.

Turn the axles to the dimensions given, making careful note of the drillings carried on beyond the centre drillings in the axle ends, for they are going to be put to use in the case of the driving axle, if not the other two axles. In this connection, make the axles "belong" to definite pairs of wheels, so that you can turn the ends of the shafts to be a good drive-on fit in the wheel seats, and any slight differences in diameters will no longer matter. The parts that are to carry the long sleeves must be both smooth and

parallel, and chamfered slightly at the outer ends.

Now set about the sleeves or inner races, boring them to be a medium drive fit on the shaft, and keeping the outside concentric with the bore, a condition best maintained by the procedure described for the outer races, and finally, keep the length just about right.

It will depend on the tools you possess as to

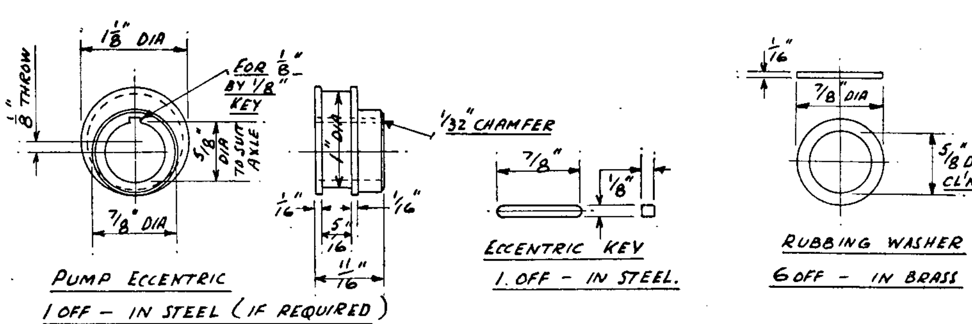


how you will get the very final diameter after hardening. Taking the methods from luxury right down to abject poverty, a state most of us enjoy in varying degrees, the methods would be as follows: Bribe your neighbour to do it on the cylindrical grinder at his works. Grind it yourself between centres on the lathe, using either a grindstone in the drill spindle or an electric toolpost grinder. Say good-bye to your friends, and spend the next three weeks with a coarse lap which, by the way, and all joking apart, is quite a good method and not quite as long drawn out as suggested, but would entail leaving much less metal on the outside diameter of the sleeve before hardening, say three thousandths instead of five or six.

afterwards heating the parts covered, in a hot flame or fire, much as we did with the well-known powders for ordinary case-hardening. Here again, the penetration and hardness obtained depends on the number of times the parts are dipped and reheated, and from simple tests it would appear that, for safety's sake, about one thousandth is penetrated per performance.

I use a small steel bath filled with the powder, and this is surrounded by firebricks, and heated by a gas/air blowlamp. The powder melts, taking on a deep red port-wine colour, and becoming a heavy liquid. The parts to be treated are submerged in the bath, and kept there from twenty minutes to half an hour. I estimate the penetration to be somewhere about ten thousandths, but I cannot be sure; in any case, it has proved to be quite deep enough, and subsequent grinding operations failed to uncover any soft spots. As the hardened sleeves have to be pressed or driven on to the axles, it stands to reason that an all-hard sleeve might crack or burst; but by keeping the core of the sleeve in a soft state, a certain amount of elasticity is retained. I kept a careful watch for fine surface cracks, using a magnifying glass, and after keeping close watch for some days after the pressing-on operation, I felt satisfied that all was well, and the method was a safe one to pass on to the poor unsuspecting builder of small locomotives. Watch out for one thing, however, and mind the splash when you quench out in water (hot water as before). Finally, don't heat up and use the cyanide bath in the work shop—it does the quaintest things to bright steel work and tools left lying about.

There are also two felt washers in each axlebox, to keep the oil in and the dust and ashes out of the bearing. I have arranged for a supply of these to be available when they are needed.



Whichever method be employed, it is easy to watch the diameter coming down under treatment, and removal from the lathe or grinder for a test assembly will not prejudice the final result.

The theoretical diameter should be one thousandth under the bore size of the outer race, plus the diameter of the rollers twice.

Before any of this can be done, the races and washers have to be hardened, and again, two methods are possible. The first and simplest way is to heat the parts to a dull to medium red, and roll them in a quantity of the powder, and

Before assembling the axleboxes on the three axles, the pump eccentric should be made and either keyed or pinned to the driving axle; that is, if you have decided in favour of fitting this pump at all. Its position on the shaft is dead central—that is to say—with the track of the eccentric in the mid-position. It does not really matter which side the boss goes as there is plenty of free space on either side of it. The ideal fixing is the proper key, $\frac{1}{8}$ in. by $\frac{1}{8}$ in. by $\frac{7}{8}$ in. long, including the rounded ends. An end-mill may be used to cut the keyway in the

axle, and the corresponding way in the eccentric may be either slotted out, planer style, or cut and filed by hand. I favour planing out in that it is more likely to produce a slot square on with the bore. Mild-steel is quite good enough for the key, and stainless if the axle is in the same material.

Whatever you do, refrain from putting in a huge hexagon-head set-bolt which relies for grip on sheer tightness, or lodgement in some indifferently-drilled sink in the axle. Better than this is the through pin, either parallel or taper, and not exceeding 3/32 in. diameter and steps taken to see that it cannot work loose and come out under stress. As to position, I suggest that, when the first wheel is pressed on this axle, the throw of the eccentric should match one of the crank throws—no matter which one.

The axle boxes may now be assembled, and I found the following method to be quite sound. Set out in a row, the three shafts together with the axleboxes in accordance with their numbers and positions. Take the first axlebox with its cover removed, placing the latter on the axle the right way round and supporting it by a rubber band wound round the shaft once or twice. Push a felt washer into the cavity turned for it, followed by one of the hardened steel washers. Take an outer race ring and after trying it for fit in its own axlebox, stand the race on the top of the washer with the axle held vertically, and insert the rollers one by one, keeping a small pressure on the side of the race with the thumb, to stop the rollers, already in place, from falling down. When the requisite number of rollers are fitted, slip the companion steel washer on the top, and stand the assembly on one side. Push another felt washer in the cavity of the axlebox which may now be placed on the top of the shaft and roller unit. Bring the hole and sink in the outer race, in line with the corresponding hole in the top of the axlebox, and squeeze the lot together between the fingers and, if the fits of the parts are correct, this will give no trouble at all. Before turning the axle to try the bearing, prepare a temporary bolt or screw to put into the top tapped hole of the bearing, and this will prevent the outer race working round in its housing. The studs or set-bolts may now be put in place, and the whole lot tightened up. You may notice a very small gap left between the axlebox face and the bearing cap; this is quite in order, denoting a pinch grip on the sides of the roller race outer member—the intended method of keeping the race held firmly and without risk of distortion. When inverting the axle to perform on the other end, don't forget to put a rubber ring under the box just assembled, or you may wonder how it happened to be under the dining room table.

Finally, do not expect to find the bearing as sweet and silky as a new ball-bearing, as it will take a little time to get itself adjusted and run in. It should not be necessary to fill the boxes with oil at this stage, and, when oil is used it should be no thicker than the usual light machine oil, much the same as you use for the lathe bearings.

The drawing shows some little screwed caps to go in place of the temporary bolts on the top of each box. This part is cupped on the top to take the rounded end of the spring mounting, and is drilled through from the side to take an oil feed connection in the case of "Major," and a simple oil cup in the case of "Minor." These little fitments will be described later on with some of the other trimmings.

The mention of "Minor" reminds me that not a word has been said about her axleboxes. The drawing shows some very simple axles, and axleboxes with exactly the same exterior as for "Major," but having simple bores to take the axles. These boxes have two small holes drilled through from each side, in order to carry some lubricant to the horn cheeks. When making the axles, try to put a very good surface on the journals and, after the usual session with various grades of emery paper, give them a brisk burnishing with a piece of crocus paper, in the very finest flour grade.

As a final word of warning to the "Major" folk, be quite sure the top oil fitting is not made too long in the thread. The cone point should engage with the sink provided in the outer race without any pinching, when this fitting is screwed down tight. It serves as a loose keep for the bearing, and just prevents the race oil hole working away, out of reach of the feed. To make sure the side entry to the fitting, comes in the right place when tightened, screw it down hard, scratch the position for the hole in the side, remove and drill.

(*To be continued*)

A TEES-SIDE EXHIBITION

Six thousand, three hundred and forty-three visitors in 48 hours—more than two a minute—such was the drawing power of the first annual exhibition of the Tees-side Society of Model and Experimental Engineers held in Middlesborough! A visit to the exhibition soon convinced one of the reason for the big draw, for some £6,000 worth of models ranged from a full-rigged frigate inside a tiny flashlamp bulb to a 7¼-in. gauge locomotive were on show.

While the locomotive section was a strong one, the exhibits which came from Newcastle, Stockton, Redcar, the Hartlepools, Northallerton, as well as a good number from local enthusiasts, included some very fine beam engines, power boats, yachts, aeroplanes, as well as praiseworthy products from local technical schools.

A set of 4-mm. scale signals lit by electric light caused a few arguments, until it was discovered the tiny "lamps" were really reflected light up the hollow signal posts from a bulb in the base.

One of the big attractions, of course, was the 5-in. gauge 0-6-0 locomotive owned by Mr. A. W. N. Brown, of Eaglescliffe, which did a roaring trade hauling passengers on a portable track running the full length of the hall.

The society was quite overwhelmed with the success of the exhibition and hopes to stage an even larger event during the coming winter.

PRACTICAL LETTERS

"Hedgehog Boilers"

DEAR SIR,— I think Mr. Westbury has done well to draw readers' attention to the possibilities of the "hedgehog" boiler in your issue for June 30th. I do not know what results Mr. Crebbin obtained with his boiler, but the "hedgehog" boiler was invented long before Mr. Crebbin's experiments. Possibly the following short extracts from *Hoblyn's Manual of the Steam Engine*, published in 1842 will be of interest to readers and encourage further experiment.

"A contrivance has recently been introduced by Mr. C. W. Williams of Liverpool for effecting a more rapid generation of steam, without increasing the size of the boiler or requiring additional fuel. His plan is to insert a number of iron pins through the plates of the boiler. These pins, exposed at one end to the heat in the flue, act as powerful conductors, through the boiler plates, of the heat into the water."

Mr. Williams apparently demonstrated his theory very convincingly by means of evaporating pans and, finally: "Mr. Durance, engineer of the Liverpool & Manchester Railway, stated that he had tried the conducting pins in the boiler of one of their stationary engines with great success. He had only 105 pins driven into the boiler, and the steam, which could not before be kept up, was now abundant."

Yours faithfully,

Swanage. H. E. RENDALL.

That Fine Adjustment

DEAR SIR,—I have just been reading the article by Mr. K. N. Harris on his fine adjustment reversing lever, and am puzzled as to why a man of the undoubted capabilities of Mr. Harris should go to the elaborate lengths to which he has gone for a gear which cannot be notched up. This gear, which is now obsolete, is quite useless for an engine of, I presume, $\frac{3}{4}$-in. scale and intended for continuous running, as well as being a very clumsy job, as instanced in the photograph accompanying the article.

I have a $\frac{1}{2}$-in. scale locomotive fitted with this gear and it was designed in about 1912/1913, and came from the then well-known firm of Baldwin & Wills.

At that period, passenger-hauling in this gauge was unknown; so the gear fulfilled its purpose, being used mainly on "Scenic" layouts, where no notching-up was attempted. Since then, however, we have progressed! Mr. Harris could quite easily have made himself a decent-looking and efficient gear and just used an ordinary quadrant with about four notches either side, with which many hundreds of successful locomotives are fitted. Just 9 screwcuts instead of a 160-tooth wheel, rotary tables, division plates, etc.

Yours faithfully,

Eccles. "Curious."

Chemical Plating

DEAR SIR,—May I draw your attention to the above article which, as it stands, is incorrect. Silver chloride is insoluble in water. How can you wash a precipitate in water and then proceed to dissolve it in the same solvent? Of course, the answer is that you dissolve it in a solution of sodium cyanide.

It hardly seems worth while depositing such a thin plating of silver that you have to protect it with a lacquer, when by means of a small accumulator you can get a lasting coating by electro-deposition.

Yours faithfuly,

Minehead. H. STOCKER HARRIS.

Anodising

DEAR SIR,—With reference to Mr. L. Camidge's article "The Anodising of Aluminium and its Alloys" which appeared in the issue dated June 16th, I feel bound to point out a serious error.

Mr. Camidge states (and his sketch confirms) that the job is to be made cathode. If this were carried out, all that would occur on passing current would be the oxidation of the lead lining and a partial reduction of any oxides present on the surface of the aluminium, with, also, some embrittlement of the latter, due to hydrogen absorption.

If d.c. is to be employed, the work must, as is indicated by the title of the process, be made *anode*.

The current density suggested is also much lower than is commonly used in present practice; the figure of 18 to 20 amps. per sq. ft. being more usual. I would like, also, to suggest that boiling the anodised work in water for about 10 minutes is preferable to steaming, as the uniform temperature thus obtained tends to obviate any internal stresses in the anodic film, and gives better homogenisation and hydration.

Yours faithfully,

Stockport. LESLIE WARBURTON.

Tube Bending

DEAR SIR,—As a coppersmith of 27 years' experience I feel I must point out what I consider a mistake in a recent article on tube bending. It stated that, after annealing, brass tube should be quenched in water; this is contrary to practice in our works, all brass, whether tube or sheet, is allowed to cool in the air. Another tip is that resin is nearly always used as a filling. This is melted down, poured in the tube and allowed to set. Bending is then proceeded with, and the puckers in the throat of the bend can be hammered out quite easily as the resin sets very hard, when finished the bend is gently warmed and the resin melts out easily. This is a much better way than filling with lead.

Yours faithfully,

Norwich. H. G. HOWARD.